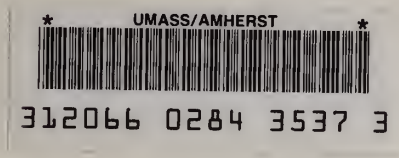
July 1987



Inventory of Traffic Issues
TOWN OF BELLINGHAM

Metropolitan Area
Planning Council
110 Tremont Street
Boston, MA 02108

Inventory of Traffic Issues

for

Town of Bellingham

July 1987

Metropolitan Area Planing Council

110 Tremont Street

Boston, MA 02108

Table of Contents

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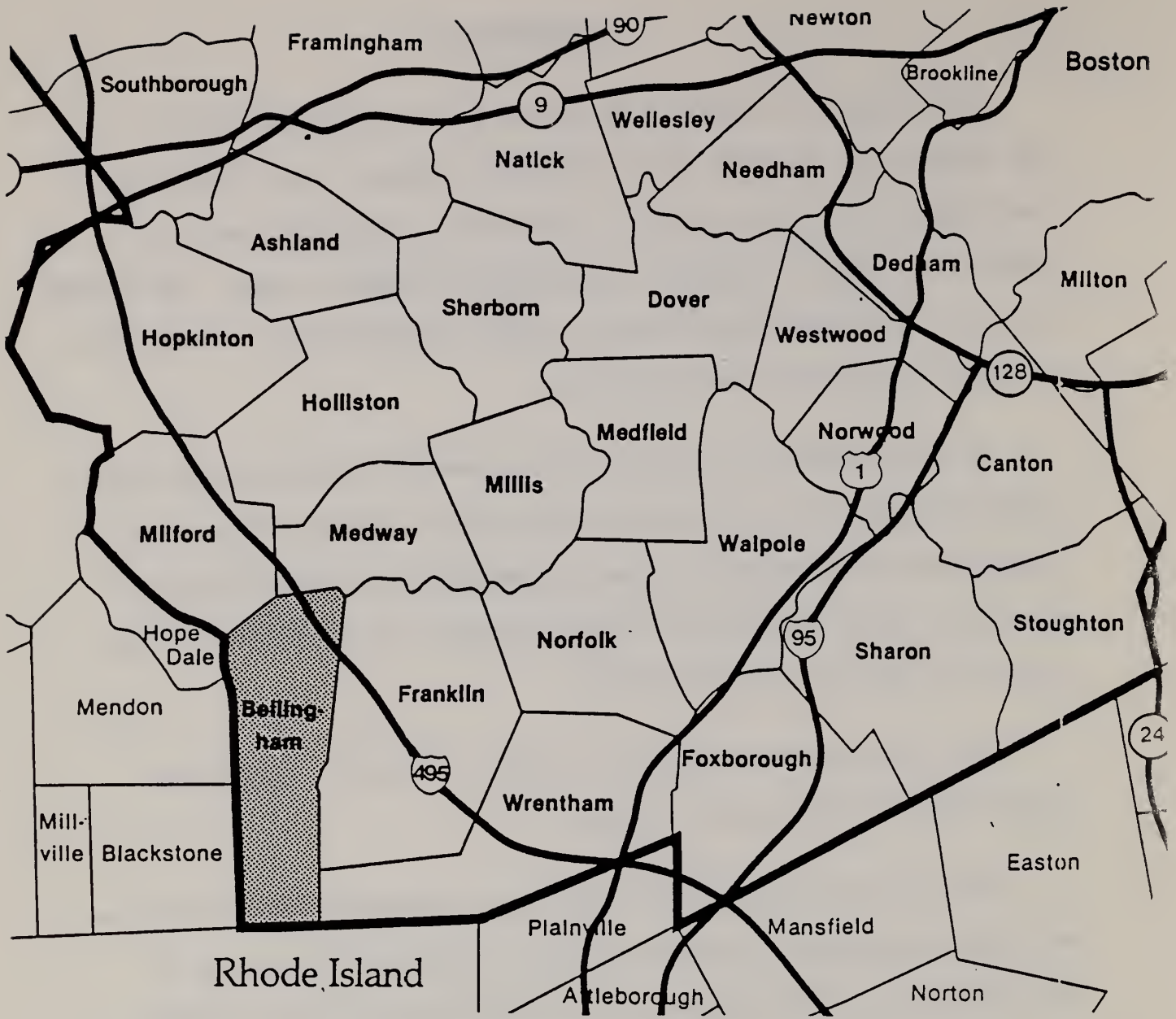
I INTRODUCTION

Bellingham is a community of approximately 15,000 population in the southwest of the MAPC region bordering on Rhode Island (Figure 1). The community has direct access to I-495 with a substantial amount of vacant land zoned for industrial development located on I-495. Bellingham, as most of the communities along the I-495 circumferential, is beginning to witness increasing growth pressures.

It is the objective of this study to generally summarize the overall traffic problems and to study the intersections of Routes 126 and 140 (South Main Street, Mechanic Street and Mendon Road) and Hartford Ave. North Main Street and Cedar Hill Road in detail and to recommend future actions to resolve existing problems.

This study would not have been possible without the cooperation of both town officials and the public.

Early in the study, MAPC staff met with representatives of the fire and police departments, highway department and Board of Selectmen to list the major traffic problems in the town that were later included in a survey. In addition the Police Department assisted in the collection of accident data. The Executive Administrator coordinated town employees in conducting turning movement counts at two locations. The Planning Board provided information on future development within the town.



LOCATION OF BELLINGHAM

Figure 1

II. TOWN GROWTH

Recent growth and growth that will take place in the near future, based on announced development was taken into consideration primarily to aid in predicting future traffic increases. Traffic increases based on the past five years have been estimated to be between one and two percent per year. Based on anticipated growth in Bellingham, the fact that there is plenty of room for growth, and its strategic location, the annual traffic growth rate will probably exceed the two percent per year and can easily be as high as three percent.

A. Future Development

The Planning Board provided a summary of anticipated developments in the town. Table 1 is a listing of 11 current announced developments at various stages, some which have yet to be approved. This table shows a total of about 1250 new dwelling units in addition to a commercial plaza and the development of 28 industrial acres. This information is as March 1986 and includes only those developments that are proposed.

Assuming three persons per dwelling unit these 1,250 units will increase population by 3,750 people or 27 percent over 1985 population. This increase could be translated to a similar growth in traffic which will be compared by increased employment and increased activities in surrounding towns. In addition there is considerable land available along I-495. Figure 2 also shows the location of developments listed in Table 1. Table 2 is a summary of the 1980 survey of existing land use. This table shows 2,982 acres out of 11,949 acres as developed or 25 percent. Of course

many of the remaining acres can not be developed, such as wetlands and some agricultural land. On the other hand much of the already developed land can be developed more intensely.

It is reasonable to assume, given the available land in this community, its proximity to I-495, improved commuter rail service to Boston and the new proposed rail station on I-495, that Bellingham will witness a future growth in both population and employment that will be proportional to, or greater than, the rest of the region. As a result, traffic growth will exceed the regional average of one to two percent per year.

TABLE 1

SUMMARY OF PROPOSED LAND DEVELOPMENT[1]
BELLINGHAM, MASSACHUSETTS
MARCH, 1986

Map No.	Proponent	Development	Description	Assessor's Map Designation	Approximate Acreage
1	ROL Realty Trust Joseph Menfi One Airport Road Hopedale, MA	Bellingham Plaza	150,000 s.f. commerical space	75 - 12, 13	17
2	Blakely Co. 85 Devonshire Street Boston, MA 02108	Meadowood	264 residential condominium units 27 - 3 bedroom units 237 - 2 bedroom units	75 - 15 79 - 7	107
3	Roland Lavallee 165 Bellingham Street Bellingham, MA	Fairview Park	9 single family residential lots	80 - 12, 18, 19 20, 21, 26 to 28 84 - 14, 14A	55
4		Pheasant Hill	19 residential lots	75 - 7	28
5	Gilbert Trudeau 85 Elm Street Bellingham, MA	Elm Estates	22 residential lots	86 - 15	30
6	Fafard Companies 290 Eliot Street Ashland, MA	Shores of Silver Lake	450± residential condominium units	72 - 13, 14 63 - 28	164
7	Davna Corp. Millis, MA	Bellwood Condominiums	136 residential condominium units	49 - 33A	70
8	Onallam Realty Trust 1275 Main Street Millis, MA	Crystal Springs Condominimums	84 residential condominium units	50 - 83 55 - 56	44
9	Celtic Companies, Inc. P.O. Box 186 Bellingham, MA	Maplebrook Condominiums	250 residential condominium units	56 - 6 51 - 1	100
10	Onallam Realty Trust 1275 Main Street Millis, MA	Twin Brook Industrial Park	31 Lots (28 industrial)	9 - 2	28
11	S. Dmytryck Millis, MA	Beachwood Estates[2]	19 single family lots	-	60

1. Based on information collected from Planning Board secretary at March 18, 1986 meeting with M. Jaillet.
2. Location not shown on accompanying map due to lack of information.

FIGURE 2

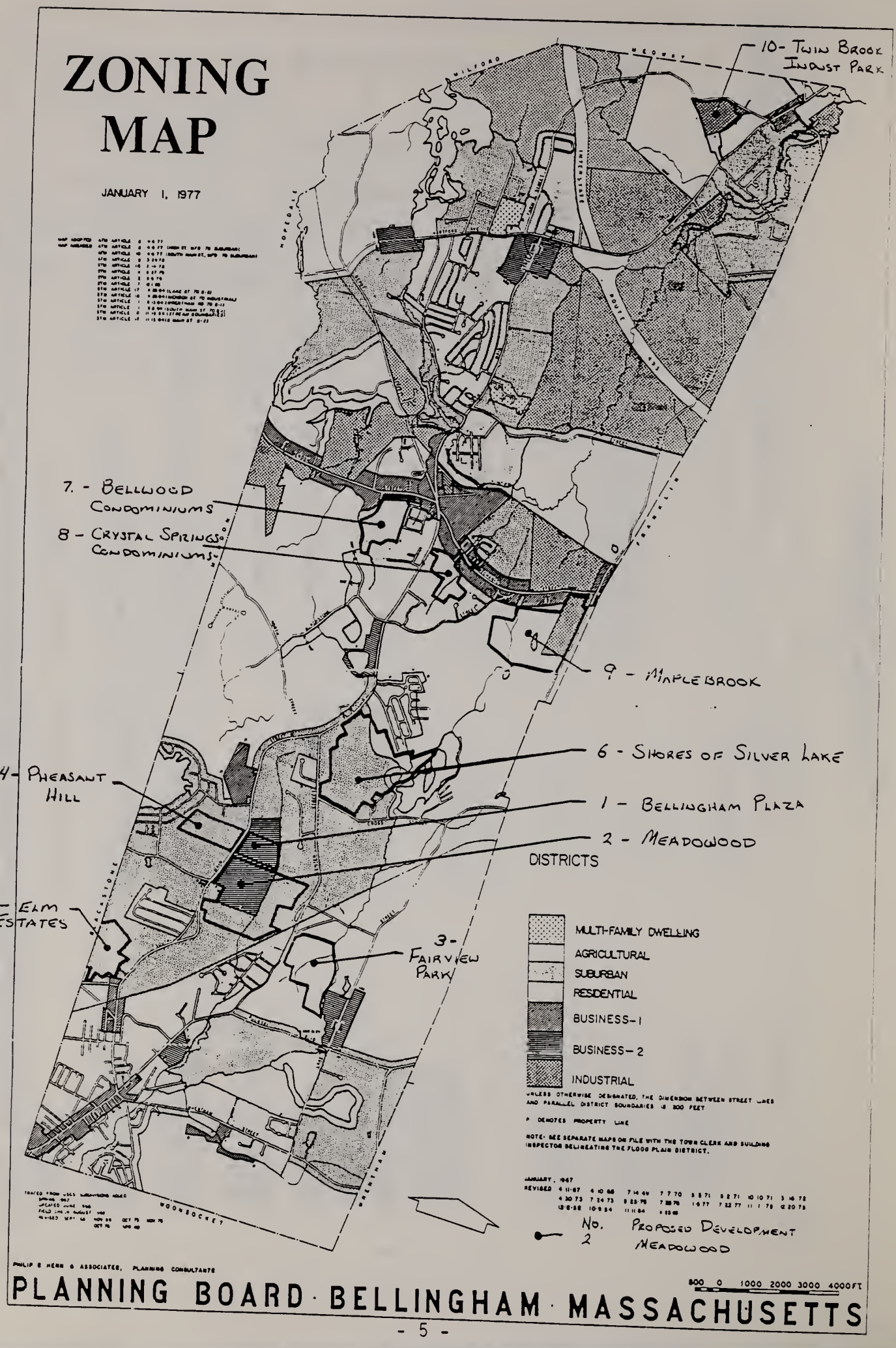

ZONING MAP
JANUARY 1, 1977
10- Twin Brook Indust Park
7. - Bellwood Condominiums
8 - Crystal Springs Condominiums
9 - Maplebrook
6 - Shores of Silver Lake
4- Pheasant Hill
1 - Bellingham Plaza
2 - Meadowood
DISTRICTS
5 - Elm Estates
3 - Fairview Park
MULTI-FAMILY DWELLING
AGRICULTURAL
SUBURBAN
RESIDENTIAL
BUSINESS-1
BUSINESS-2
INDUSTRIAL
UNLESS OTHERWISE DESIGNATED, THE DIMENSION BETWEEN STREET LINES AND PARALLEL DISTRICT BOUNDARIES IS 200 FEET
* DENOTES PROPERTY LINE
NOTE- SEE SEPARATE MAPS ON FILE WITH THE TOWN CLERK AND BUILDING INSPECTOR DELINEATING THE FLOOD PLAIN DISTRICT.
JANUARY, 1967
No. 2 Proposed Development Meadowood
PHILIP B HERR & ASSOCIATES, PLANNING CONSULTANTS
800 0 1000 2000 3000 4000FT
PLANNING BOARD · BELLINGHAM · MASSACHUSETTS

TABLE 2

METROPOLITAN AREA PLANNING COUNCIL LAND USE STUDY

BELLINGHAM

		ACREAGE 1951	change	1971	change	1980
URBAN	Industrial (UI)		+34	34	+45	7
	Commercial (UC)	52	+30	82	+27	10
	Dense Residential (RI)	10	+10	20		2
	Medium Residential (R2)	636	+691	1327	+55	138
	Light Residential (R3)	477	+519	996	+74	107
	Transportation (UT)		+129	129		12
	Open and Public (UO)	176	-16	160	+33	19
	URBAN TOTAL	1351	+1397	2748	+234	298
AGRICULTURE	Intensive Agriculture (AC)	1281	-939	342		34
	Extensive Agriculture (AP)	620	-95	525	-29	49
	Woody Perennials (WP)					
	AGRICULTURE TOTAL	1901	-1034	867	-29	838
OPEN(O)	TOTAL	198	+514	712	-48	664
FOREST(F)	TOTAL	7659	-1308	6351	-221	6130
WETLANDS	Water (W)	115	+39	154		154
	Salt Wetlands (SW)					
	Fresh Wetlands (FW)	725	-66	659		659
	WETLANDS TOTAL	840	-27	813		813
OUTDOOR RECREATION	Participation (RP)			99		99
	Spectator (RS)			32	+8	40
	Water Based (RW)					
	RECREATION TOTAL			131	+8	139
MINING(M)	TOTAL			322	+56	378
WASTE DISPOSAL(UW)	TOTAL			5		5

BELLINGHAM ACREAGE TOTAL 1194

Photointerpretation was done by the Remote Sensing Project, Department of Forestry & Wildlife Management, University of Massachusetts, Amherst.
1980 acreages are based on an interpretation of 1980 aerial photographs.
1971 and 1951 acreages are consistent with the 1980 analysis and may differ from the earlier figures, which are based on different criteria.

III. TRAFFIC ISSUES

At meetings held early in the study (June 1985), town officials generally agreed that there were a number of traffic problems in the community and that anticipated growth was going to increase the severity of the problems. The general concern was the fact that these problems had not been listed nor had they been put into any type of priority order so that officials might direct their energies.

The first meeting with town officials resulted in a listing of problems that was expanded at a subsequent meeting and then used as the basis for an attitude survey. Table 3 is the list which resulted from these meetings and includes some comments and a capacity and/or safety problem identification.

A. Townwide Survey

A survey form was developed and distributed. It was completed by 59 town officials and 71 town residents in early 1986. The survey form was made available at the town meeting for residents to complete and was presented in the local newspaper. (Appendix A is a copy of the form) The numerical value of responses were added together and divided by the number of responses for that specific intersection, (not by the number of survey forms completed, because in some instances the individual may not have ranked every intersection). Table 4 is a ranking of the average value for each intersection. The higher the value the more severe the problem in the view of the respondents. The table is in order by the response from the town residents because there were more surveys. The table also includes the ranking and score for town officials. It is interesting to see the similarity of the two groups. In the residents

survey the intersection of Routes 126 and 140 rank first and Crooks Corner second, which is just the opposite for the town official survey.

Table 5 is a list of other intersections reported by those surveyed but not included on the original form. In this case only those listed more than once were included.

B. Accidents

The Bellingham Police Department provided accident information for 1984 and 1985 for those intersections included in the study where accidents were reported.

Table 6 shows that the greatest number of accidents occurs on Mechanic Street at S. Main Street and N. Main Street, followed by Paine Street and Hartford Ave./I-495. Appendix B are summary accident diagrams for the period July 31, 1985 through December 31, 1985 provided by the police department. One can observe that there is a large number of rear-end and angle accidents that could be reduced with traffic control improvements.

TABLE 3

Inventory of Traffic and Highway Issues
(no priority inferred)

Location	Issue: Capacity	Safety	Comments
Existing			
North Main St. & Hartford Ave.	X	X	Needs traffic and accident counts
Hartford Ave. Grove St. & Depot St.		X	Bad - May be PWED
Depot St.		X	Too narrow and poor pavement (PWED)
I-495 off ramp from North		X	Traffic backs up on ramp
Routes 126 & 140	X	X	Too many conflicts
Maple St. RR bridge		X	Plans exist for rebuilding
Routes 126 & Mann St.		X	Large volume of traffic and poor sight distances
Paine St.		X	Very hilly with curves and poor sight distance
Crooks Corner*	X		Programmed for reconstruction
Pulaski Blvd.-Crooks Corner to RI		X	Roadway needs more definition
Future Based on Anticipated Growth			
Hartford Ave. & Maple St.	X		Growth in area will cause traffic problem
South Maple St. and Route 140	X		Large amount of growth

*Crooks Corner is the intersection of Paine Street, Pulaski Boulevard (Route 126), South Street and Wrentham Street.

Table 4

SURVEY RESULTS

	Town Residents		Town Officials	
	Rank	Ave. Score	Rank	Ave. Score
Routes 126 & 140	1)	4.70	2)	4.64
Crooks Corner	2)	4.59	1)	4.71
I-495 off ramp from north	3)	4.35	4)	4.04
North Main Street & Hartford Avenue	4)	4.23	5)	3.88
Pulaski Blvd. - Crooks Corner to RI	5)	4.08	3)	4.32
Route 126 & Main Street	6)	3.59	7)	3.29
Hartford Avenue & Grove Street	7)	3.24	8)	3.28
Paine Street	8)	2.48	6)	3.33
Hartford Avenue & Maple Street	9)	2.41	10)	2.53
Depot Street	10)	2.34	9)	2.71
South Maple Street & Route 140	11)	1.96	11)	2.31
Maple Street RR Bridge	12)	1.94	12)	2.06

Table 5

ADDITIONAL INTERSECTIONS

ALSO LISTED (More than Once)	# TIMES LISTED	AVERAGE RANK
Residents		
Route 126 & Blackstone Street	3	4.0
Route 126 & Mann Street	2	4.0
Route 126 & Post Office Parking Lot	2	4.0
Town Officials		
Route 126 & Blackstone Street	8	3.88
Route 126 & Mann Street	3	3.33
Route 126 & Plymouth Road	2	2.00
Route 126 & High Street	2	3.50
Route 126 & Westminister Street	2	4.00

TABLE 6

ACCIDENT ANALYSIS

Town of Bellingham

(Data developed by Bellingham Police Department)

Location	Year 1984	11/1/85 to 7/31/85	7/31/85 to 12/31/85	Total
° Mann & S. Main	5	0	1	6
° Paine St.	12	4	4	20
° Mechanic (Rt. 140) at S. Main & N. Main (Rte. 126)	18	9	9	36
° Hartford Ave. at N. Main	7	3	8	18
° Hartford Ave. & I-495	9	3	8	20
° S. Main - Blackstone	2	4	1	7
° Pulaski at Lake	3	1	1	5

IV ANALYSIS OF KEY INTERSECTIONS

This analysis involves a review of traffic conditions at two intersections located in the center of Bellingham. The intersections involve the merging, and subsequent separation of traffic using Routes 126 and 140. The northern intersection is Mendon Street (Route 140) and North Main Street (Route 126), the southern intersection is Mechanic Street (Route 140) and Main Street (Route 126). Also included is the intersection of North Main Street and Hartford Avenue in the north part of town.

A. Mendon Street and North Main Street

Existing Conditions

The intersection of Mendon Street and North Main Street is a "T" type intersection. The 3 legs of the intersection are controlled by a flashing beacon. (See Figure 3)

Mendon Street serves the eastbound traffic entering the intersection. This leg is controlled by a stop sign and the red beacon. The approach consists of one shared lane for right and left turning traffic.

North Main Street serves the northbound and southbound traffic entering the intersection. These legs are controlled by the yellow beacon. Southbound traffic entering the intersection is served by two travel lanes, one for right turns and one for through traffic. Northbound traffic is served by one lane for through and left turning traffic.

The intersection is utilized by over 1,750 vehicles during the afternoon peak hour. The major flow entering the intersection is on the northbound approach, 649 vehicles (Figure 4).

Capacity analysis for the Mendon Street - North Main Street intersection shows average delays on North Main Street for left turns into Mendon Street (Appendix C-1). Extremely long delays are experienced for all movements out of Mendon Street.

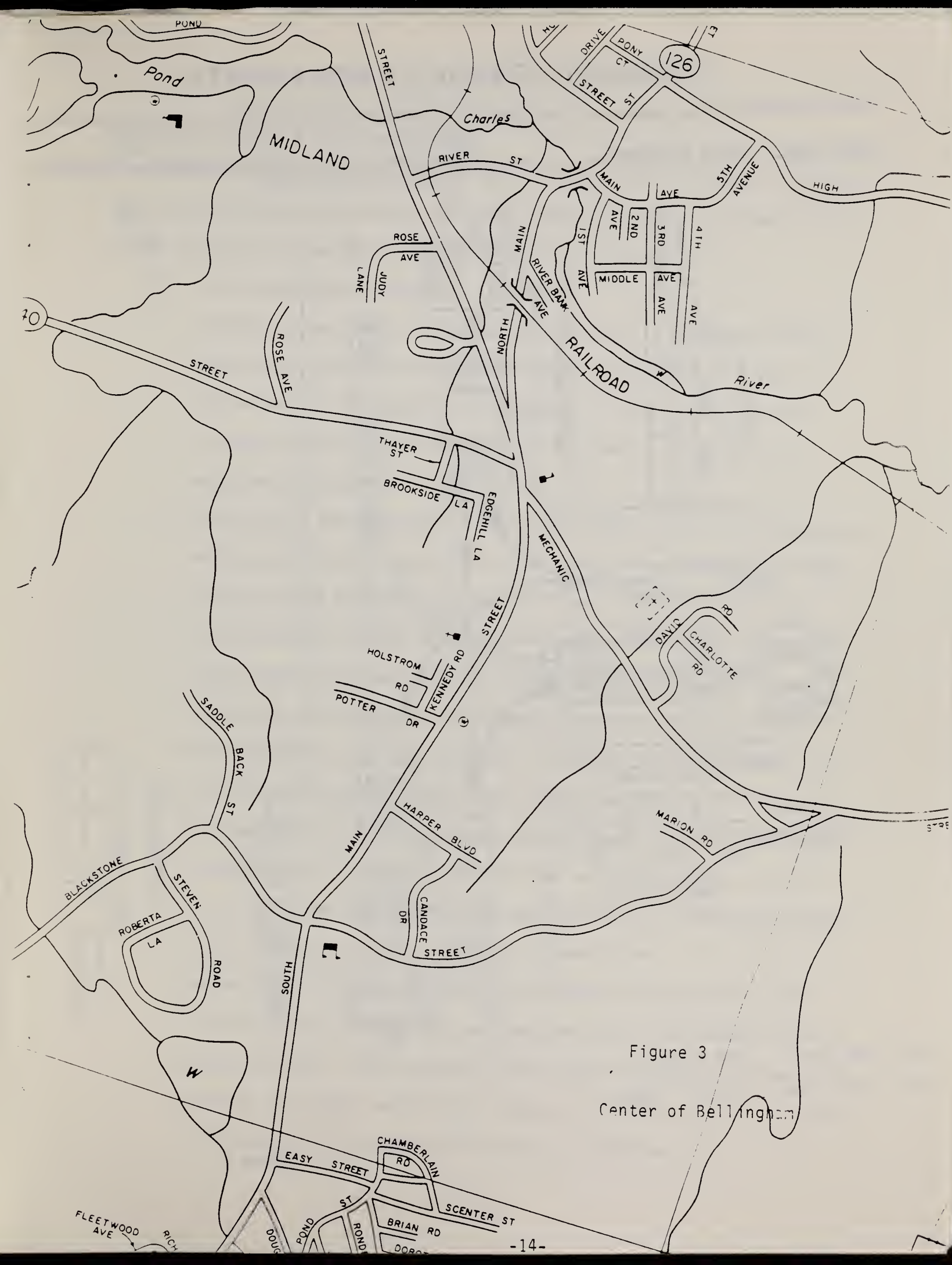


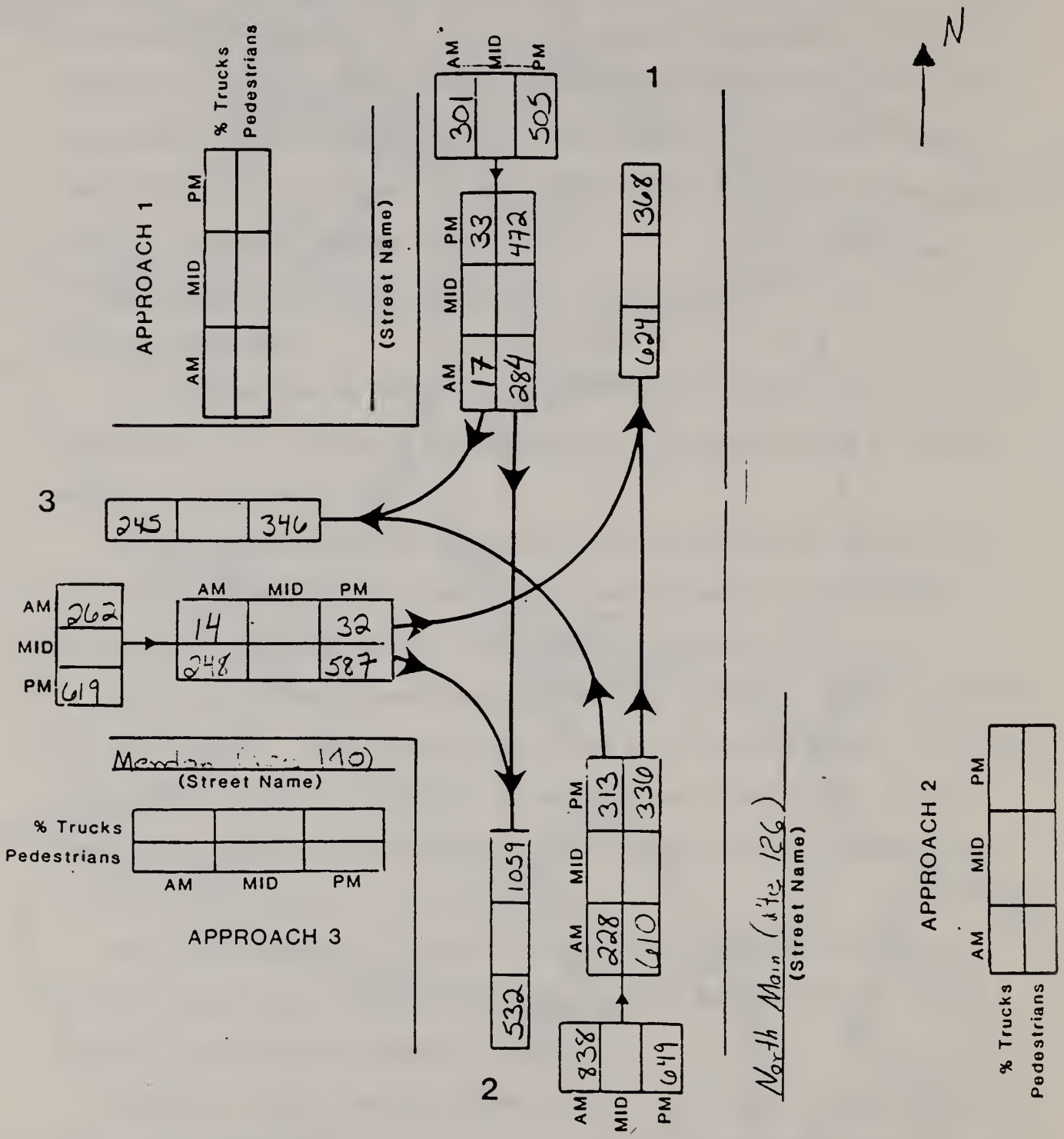
Figure 3

Center of Bellingham

SUMMARY OF VEHICLE MOVEMENTS

Intersection North Main (Rte 126) @ Meridian (Rte 140)

Date 10/29 Day of Week _____ Weather _____ Community Bellingham



AM Peak Hour : 7:15 - 8:15

PM Peak Hour : 4:30 - 5:30

Figure 4

Options to Alleviate Existing Problems

The 1985 Highway Capacity Manual was utilized to test a number of possible intersection alterations and the resultant impacts on traffic. These options are discussed below beginning with the least cost alternative.

1. Pre-Timed Signal on Existing Alignment

   Locating a pre-timed two phase traffic signal at the Mendon Street - North Main Street intersection is perhaps the quickest, least cost option for the intersection. The basis for this action would be to stop traffic on North Main Street in order to clear the leg experiencing delays.

   The analysis indicates that a two phase traffic signal would decrease delays on Mendon Street but it would result in an increase in delays for northbound traffic on North Main Street (Appendix C-2). The traffic pattern at the intersection suggests that even with optimal signal timing the average delay at the intersection would be over 6 minutes per vehicle. This indicates a level of service "F" for the intersection (all approaches).

2. Add Left Turn only Lanes on Mendon Street (No Signal)

   A second option available for the Mendon Street - North Main Street intersection is to add a left turn lane on Mendon Street. This option could be accomplished through restriping, if adequate pavement is available, or reconstructing the intersection.

   The addition of this turn lane would result in average delays for right turns out of Mendon Street and left turns into Mendon Street (Appendix C-3). Traffic making left turns out of Mendon Street would continue to suffer long delays; however, this delay would only affect an average of 32 vehicles during the p.m. peak hour.

3. Signalize the Intersection and Add Left Turn Lanes on Mendon Street and North Main Street Northbound

A third option available for the Mendon Street - North Main Street intersection would be to add left turn lanes on Mendon Street and North Main Street, and to add a two phase vehicle actuated traffic signal. As with option number 2, this could be accomplished through restriping, if adequate pavement is available, or reconstructing the intersection.

Various traffic signal phase timings were tested for existing traffic conditions in order to minimize delay at the intersection. The optimal signal timing used a 60 second cycle (Appendix C-4). This timing would result in a level of service "A" for the intersection--i.e., little or no delay.

If a traffic signal is pursued at the Mendon Street/North Main Street intersection, it should be used in conjunction with the traffic signal control discussed below for the Mechanic Street/Main Street intersection.

B. Mechanic Street and Main Street

Existing Conditions

The intersection of Mechanic Street and Main Street is a "Y" type intersection. The intersection is controlled by a stop sign on Main Street controlling northbound traffic.

Mechanic Street traffic enters the intersection from the south. The approach consists of a shared lane for left turning and through traffic. There is a sight distance problem due to the alignment of the intersection and an upgrade on the Mechanic St. approach.

Main Street serves the northbound and southbound traffic entering the intersection. Main Street northbound, controlled by the stop sign, is considered the "minor approach." The northbound approach consists of separate right and left turn lanes. Southbound traffic is served by one lane for through and right turning traffic.

The intersection is used by over 1,700 vehicles during the afternoon peak hour and over 1,400 vehicles during the morning peak. The major traffic flow entering the intersection is from the north, 1,067 vehicles, during the afternoon period and from the south, 671 vehicles, during the morning (Figure 5.).

Analysis of the Mechanic Street - Main Street intersection indicates that traffic travelling northbound along Main Street experiences extremely long delays (Appendix C-5).

Options to Alleviate Existing Problems

1) Pre-Timed Signal on Existing Alignment

   As with the Mendon Street - North Main Street intersection, the quickest, least cost option that addresses the need to move traffic through the intersection safely and efficiently would be the erection of a traffic signal at the intersection.

   This option could reduce average delay at the intersection to 56 seconds (Appendix C-6). This delay indicates a level of service "E".

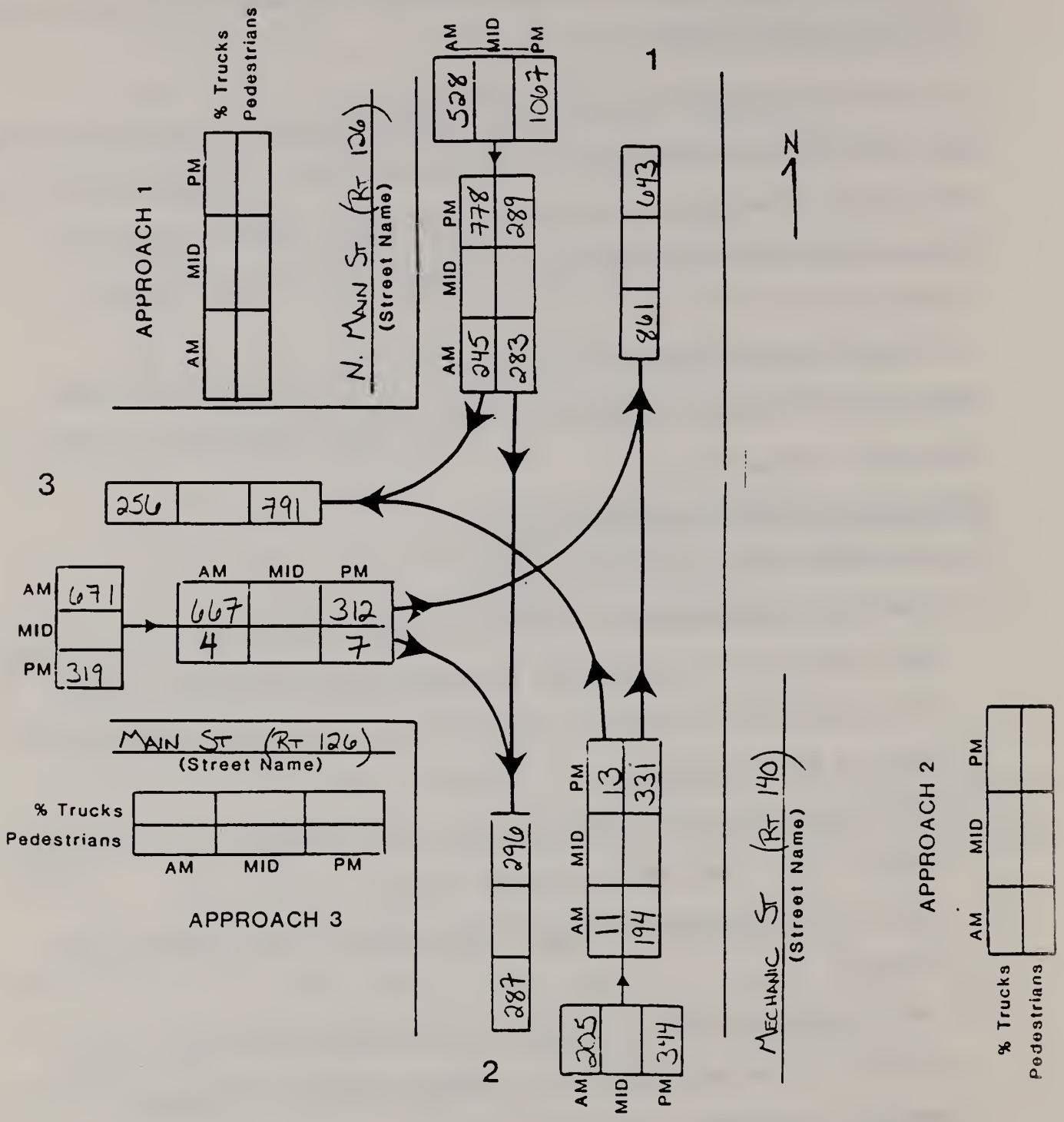
2) Signalize the Intersection and Add Right Turn Only Lane on Main Street Southbound

   A second option would be to signalize the intersection and add a right turn only lane on Main Street for southbound traffic. If adequate pavement is available, this option could be accomplished through restriping.

SUMMARY OF VEHICLE MOVEMENTS

Intersection Main St (Rt 126) @ Mechanic St (Rt 140)

Date 10/21 Day of Week _____ Weather _____ Community Bellingham



AM Peak Hour : 7:15 - 8:15

PM Peak Hour : 4:30 - 5:30

Figure 5

Analysis of this option indicates that a short cycle will be adequate. However, because the optimum timing is considerably different for morning and afternoon peak periods, the timing should be variable or vehicle actuated. Furthermore, the minimum cycle length should be set high enough to allow safe intervals for start-up and clearance. With optimal signal control this intersection would be expected to operate at level of service B during the morning peak hour and A during the afternoon peak.

If a traffic signal is pursued at the Mechanic Street/Main Street intersection it should be used in conjunction with the traffic signal control discussed above for traffic signal control discussed above for the Mendon Street/North Main Street intersection.

Looking Ahead to the Year 2005

The Planning Board for the Town of Bellingham provided the Metropolitan Area Planning Council with a map and table identifying the location of development proposals currently before the board (Figure 3 and Table 1). Although this list is incomplete, these proposals together show 1,253 residential units, 150,000 square feet of commercial space and 28 acres of industrial land.

All of the development proposals identified by the planning board, with the exception of the 28 acres of industrial development, are located such that traffic to and from Interstate 495 will traverse these two intersections. This could lead to a significant increase in traffic in the two intersections.

Looking ahead to what this new traffic and other background growth means with respect to needed improvements, we can assume, for purposes of analysis, an annual growth in traffic of 3 percent. Then the inflated traffic volumes can be tested on the alternative improvements presented above. Such an

analysis has shown that each of the options presented would fail under traffic from a 20-year projection. In 20 years, then, it is likely that major reconstruction or realignment may be necessary. One may infer that further planning for this intersection should look at both short-term and long-term alternatives, considering cost-effectiveness in each case.

Utilizing a 3% annual growth rate for traffic at the intersections results in a finding that none of the improvements identified above for the two intersections will be adequate for 2005 traffic conditions. The Town of Bellingham should identify low cost options to improve the existing traffic conditions at the two intersections while preparing for future large scale traffic circulation improvements.

C. Hartford Avenue, North Main Street and Cedar Hill Road

This analysis involves a review of traffic conditions at one intersection located in the northern portion of Bellingham. The intersection is that of Hartford Avenue, North Main Street and Cedar Hill Road.

Existing Conditions

The intersection of Hartford Avenue, North Main Street and Cedar Hill Road is a 4-leg intersection. The intersection is controlled by stop signs on each of its four legs.

Hartford Avenue serves eastbound and westbound traffic entering the intersection. The street operates as having two lanes on each approach, a through/left turn lane and right turn lane eastbound and a through/right turn lane and left turn lane westbound.

North Main Street serves northbound traffic entering the intersection. The leg operates with two approach lanes, one serving through and left turning traffic and one serving right turns.

Cedar Hill Road serves southbound traffic entering the intersection. One approach lane on this leg serves all traffic movements.

The intersection is utilized by 1,767 vehicles during the morning peak hour and 1,801 vehicles during the afternoon peak hour. The predominant traffic flow is from the south during the morning, 783 vehicles, and the east during the afternoon, 1,184 vehicles (Figure 6).

Capacity analysis suggests that the Hartford Avenue - North Main Street - Cedar Hill Road intersection experiences extremely long delays, level of service "F," on North Main Street and Cedar Hill Road during both peak hours and a level of service "E" on Hartford Avenue for left turns into North Main Street during the afternoon peak hour (Appendix D-1 and D-2).

Option to Alleviate Existing Problems

1. Pre-Timed Signal on Existing Alignment

Capacity analysis reveals that locating a pre-timed two phase traffic signal at the Hartford Avenue - North Main Street - Cedar Hill Road intersection will improve the intersection's level of service to "A" during both peak hours. This can be accomplished through the use of a 42 second cycle (Appendix D-3 and D-4).
green time for northbound and southbound traffic; it may be desirable to use a longer cycle with slightly longer delays at the intersection.

SUMMARY OF VEHICLE MOVEMENTS

Intersection Hartford Ave - North Main St - Cedar Hill

Date 11/6/85 Day of Week _____ Weather _____ Community Bellingham

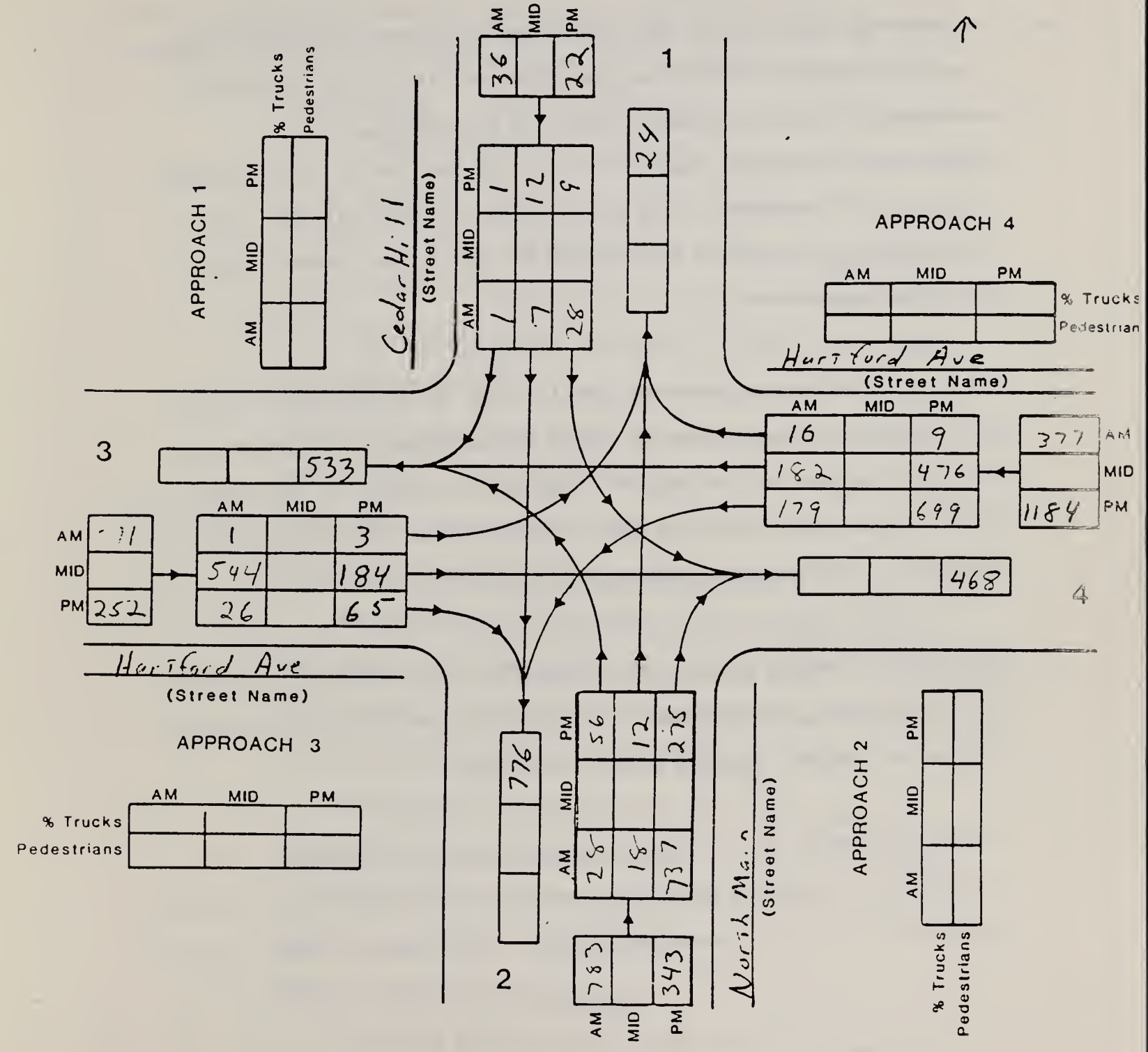


Figure 6

2005 Traffic Conditions

The Planning Board for the town of Bellingham provided the Metropolitan Area Planning Council with a map and table identifying the location of development proposals currently before the Planning Board. These combined proposals equated to over 1250 residential units, 150,000 square feet of commercial space and 28 acres of industrial land. The planning board stated that this listing did not include several other development proposals.

All of the development proposals identified by the planning board, with the exception of the 28 acres of industrial development are located such that the intersections studied will need to be traversed by development traffic to and from Interstate 495. This could lead to a significant increase in traffic in the intersection.

Utilizing a 3% annual growth rate for traffic at the intersection results in a finding that the improvements identified above for the intersection will not be adequate for 2005 traffic conditions.

Future development may create the need to change the alignment of this intersection to correct the offset configuration. This will be especially important if a fully actuated multi-phase traffic signal becomes necessary.

C. Other Intersections

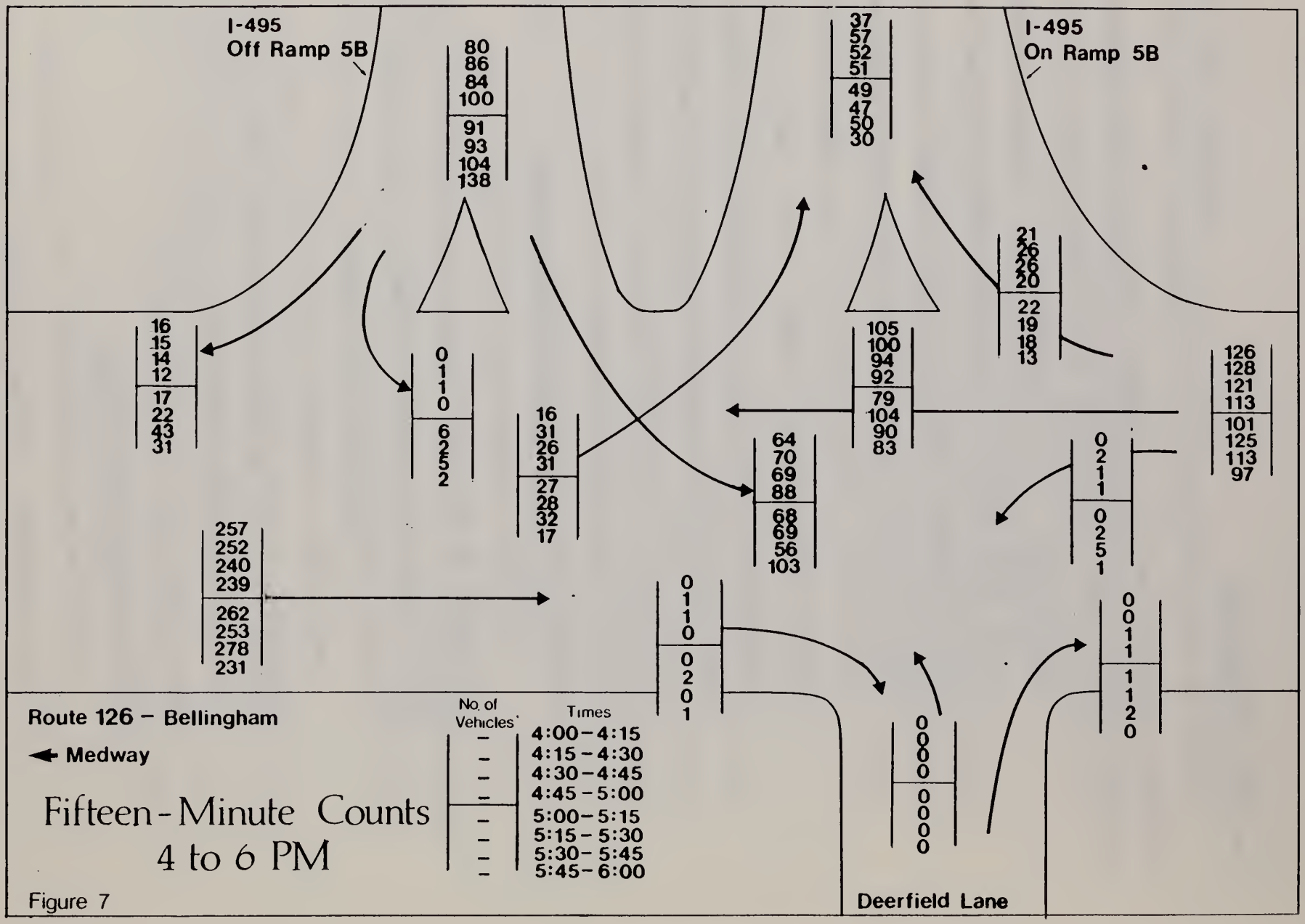
Although the traffic analysis was only conducted for the three intersections previously discussed, some data was collected and observations were made on a few additional intersections. That material and information follow:

1. Crooks Corner - This intersection was scheduled for construction during 1986; therefore no particular observations were made.
2. I-495 Off Ramps - Local officials are concerned with the growth in traffic on the I-495 off ramps and the growth in traffic that is likely to occur in the near future. They made the counts included in Figure 7 , but, due to time requirements an analysis was not conducted. It is recommended that additional counts and an analysis be made for both peak periods. This should include traffic related to both residential and industrial growth.
3. South Main Street (Route 126) and Mann Street

   Mann Street provides access from South Main Street, Bellingham, to the Town of Blackstone and south into Woonsocket, Rhode Island. As a result, it probably carries a higher level of traffic than would have been expected.

   Mann Street is regulated with stop signs and the intersection has a flashing beacon. A high private hedge on the southwest corner obstructs the visibility of traffic entering Route 126.
4. Hartford Avenue and Grove Street

   There have been four fatalities in the last two years at this intersection. Hartford Avenue has a poor sight distance, is on a curve and grade. Vehicles entering the intersection from Grove Street southbound have a poor view of Hartford


I-495
Off Ramp 5B
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240
239
262
253
278
231
0
1
1
0
0
2
0
1
0
0
0
0
0
0
0
0
0
0
1
1
1
1
2
0
Route 126 – Bellingham
Medway
No. of Vehicles
Times
4:00–4:15
4:15–4:30
4:30–4:45
4:45–5:00
5:00–5:15
5:15–5:30
5:30–5:45
5:45–6:00
Fifteen-Minute Counts
4 to 6 PM
Deerfield Lane

Figure 7

Avenue traffic.

Because some of this area is industrially zoned, there is likely to be a large growth in traffic in the future.

During the process of this study the state agreed to the reconstruction of the intersection. These improvements shall consist of straightening and improving the safety at the intersection. This project is currently at the 100% design stage and will be funded through Chapter 90 funds.

V. CONCLUSIONS AND RECOMMENDATIONS

This study has served to summarize the various traffic problems in the Town of Bellingham and has, as a result of the attitude survey, assigned priorities to those traffic problems that have been recognized by town officials and residents. The establishment of the priority should be used by the town in approaching resolutions to traffic problems. Crooks Corner's traffic problems have already been addressed and should be resolved in the near future. This study with the collection of turning movement counts has included an analysis of the intersections at Route 126 and 140, and N. Main Street and Hartford Ave. The analysis has shown that improvements can be made to these intersections to reduce congestion and accidents. The town should consider meeting with the MDPW district office to discuss obtaining professional engineering services to develop design plans for improvements.

Future Growth

Bellingham is one of the low population outer belt communities that has begun to witness demands for growth; growth that adds traffic to the highway system. It is important that the Bellingham Planning Board continue to address future traffic estimates as they look at new developments and require developers to make improvements off the site.

The Planning Board working with the highway superintendent and Board of Selectmen should review the town's curb-cut policy to determine if it should be revised to give the town more control over the location and size of curb-cuts. Controlling curb-cuts improves traffic operations.

Other issues that should be addressed by town include:

- Encourage update of County Base map series.
- Develop general recommendations for each intersection.
- Make Planning Board aware of traffic problems, and the need to have developers address off-site improvements, i.e. - developer commitment of right-of-way and impact fees.
- Work with MDPW to continue to address traffic problems on state highways.

Appendices

Appendix A

Bellingham Letterhead

December 10, 1985

Dear Bellingham Official:

The Bellingham Board of Selectmen in cooperation with the Metropolitan Area Planning Council is conducting a traffic study for the town. The study will include a detailed analysis of the intersections of Hartford Avenue and North Main Street and the intersection of Routes 126 and 140. In addition the study will include the development of a list of other traffic problems. An effort will be made to put this list in priority order.

As a result of a number of meetings held with town officials the attached list of traffic problem areas has been developed. We are now requesting that both town residents and officials take the time to rank these problems. We will put this information together into one list of priorities. Please indicate your priority for each problem listed. There is space to list additional problem locations if you wish.

Please return this material to me at the Bellingham Town Hall by _____.

Thanks for your assistance.

Sincerely,

Michael A. Jaillet

Appendix A (con't)

INVENTORY OF TRAFFIC AND HIGHWAY ISSUES

Town of Bellingham

Please rank each of the following projects from 0 to 4. Zero (0) represents no problem in your opinion and 4 represents a severe problem that should be resolved.

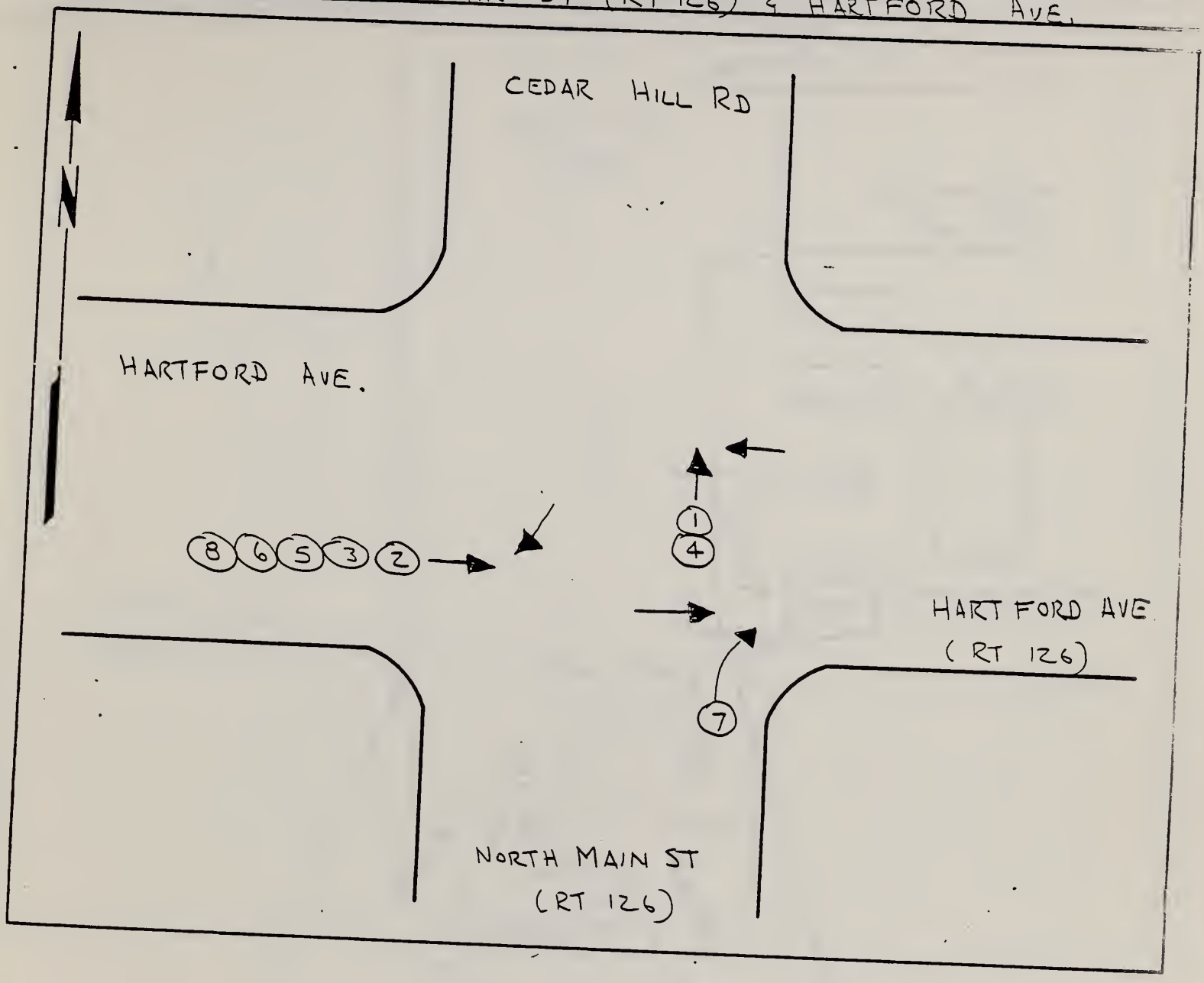
	Problem Ranking (Please circle)				
	No problem		Medium		Severe
North Main St. & Hartford Ave.	1	2	3	4	5
Hartford Ave. & Grove St.	1	2	3	4	5
Depot St.	1	2	3	4	5
I-495 off ramp from North	1	2	3	4	5
Routes 126 & 140	1	2	3	4	5
Maple St. RR bridge	1	2	3	4	5
Routes 126 & Main St.	1	2	3	4	5
Paine St.	1	2	3	4	5
Crooks Corner	1	2	3	4	5
Pulaski Blvd.-Crooks Corner to RI	1	2	3	4	5
Hartford Ave. & Maple St.	1	2	3	4	5
South Maple St. and Route 140	1	2	3	4	5
Additional locations (list)					
_____	1	2	3	4	5
_____	1	2	3	4	5

Please return by
Return form to Michael A. Jaillet
Administrator
Bellingham Town Hall

ACCIDENT DIAGRAM

TOWN BELLINGHAM DATE 7/31/95 to 12/31/95

INTERSECTION NORTH MAIN ST (RT 126) & HARTFORD AVE.



LEGEND

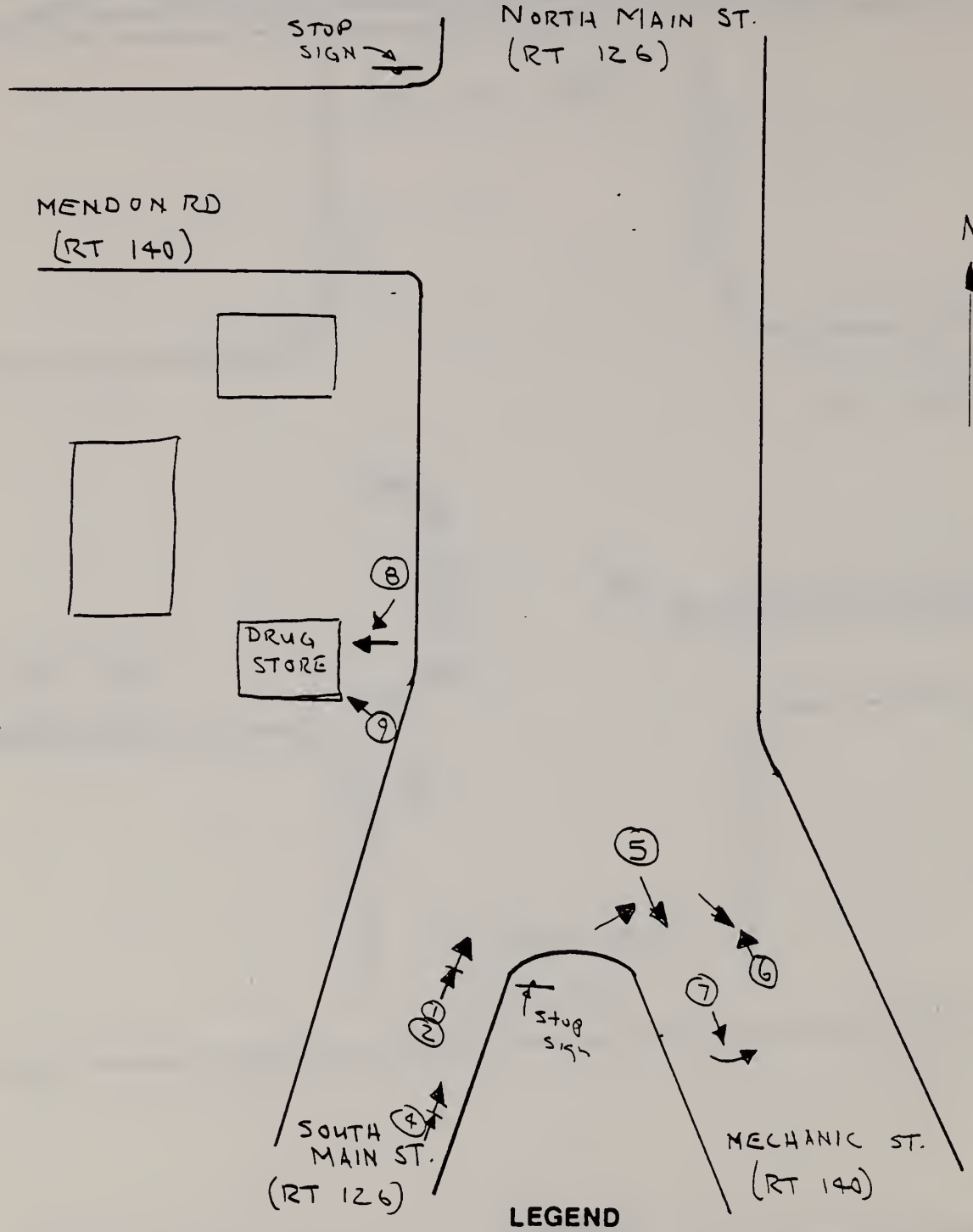
Head On	Fixed Object
Rear End	Lost Control
Angle	Pedestrian
Backing	Parked Vehicle

ACCIDENT DIAGRAM

7/31/85 to 12/31/85

TOWN BELLINGHAM DATE

INTERSECTION SOUTH MAIN ST (RT 126) & MECHANIC ST (RT 140)



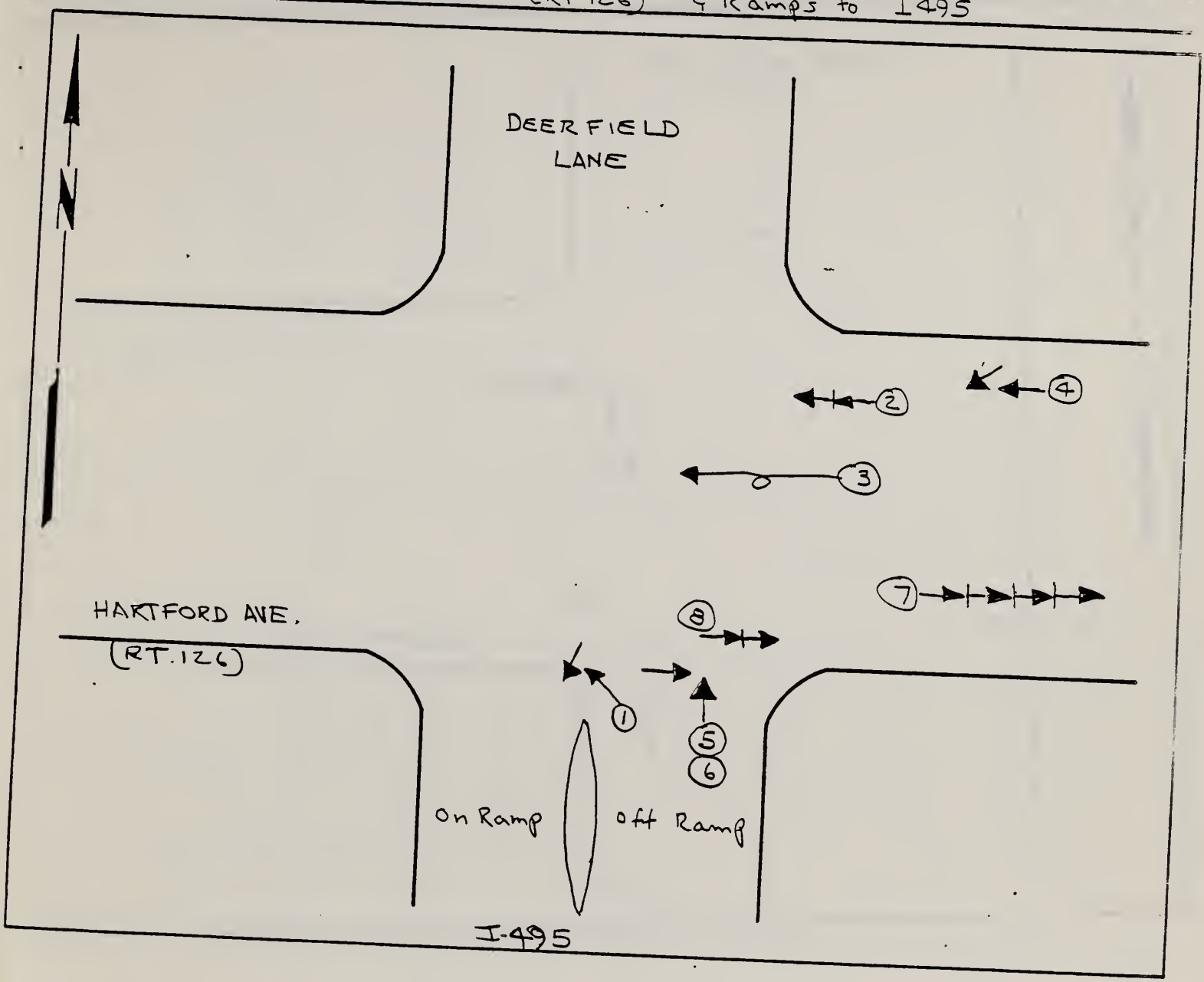
LEGEND

→ ←	Head On	□ ←	Fixed Object
← | ←	Rear End	← ○	Lost Control
↓ ←	Angle	○ ←	Pedestrian
← → | ←	Backing	▨	Parked Vehicle

ACCIDENT DIAGRAM

TOWN BELLINGHAM DATE 7/31/85 to 12/31/85

INTERSECTION HARTFORD AVE (RT 126) & Ramps to I495



LEGEND

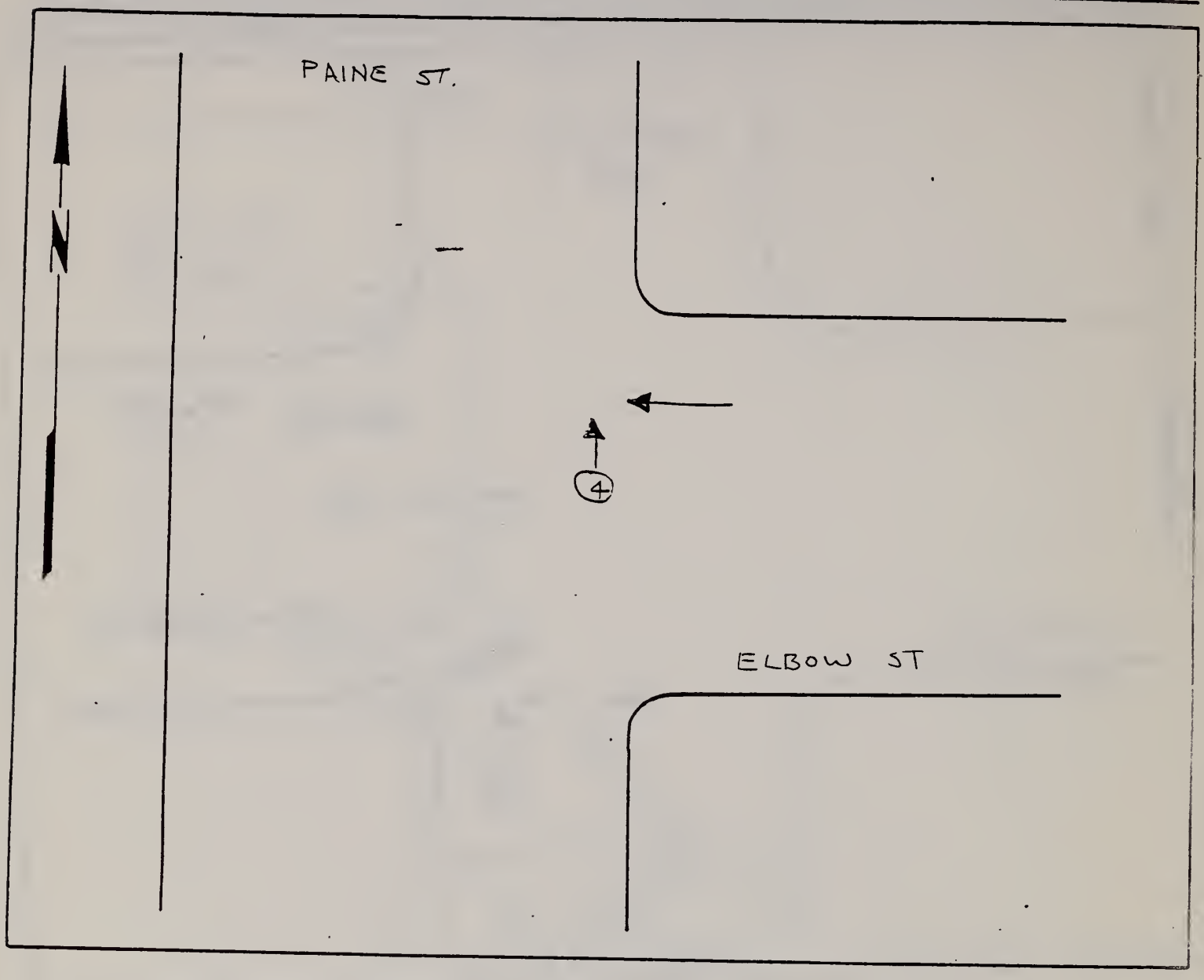
	Head On		Fixed Object
	Rear End		Lost Control
	Angle		Pedestrian
	Backing		Parked Vehicle

ACCIDENT DIAGRAM

7/31/85 ⊢

TOWN BELLINGHAM DATE 1985 12/31/85

INTERSECTION PAINE ST. & ELBOW ST.



LEGEND

→ ←	Head On	□ ←	Fixed Object
← |←	Rear End	← ○	Lost Control
↓ ←	Angle	○ ←	Pedestrian
← →| ←	Backing	▨	Parked Vehicle

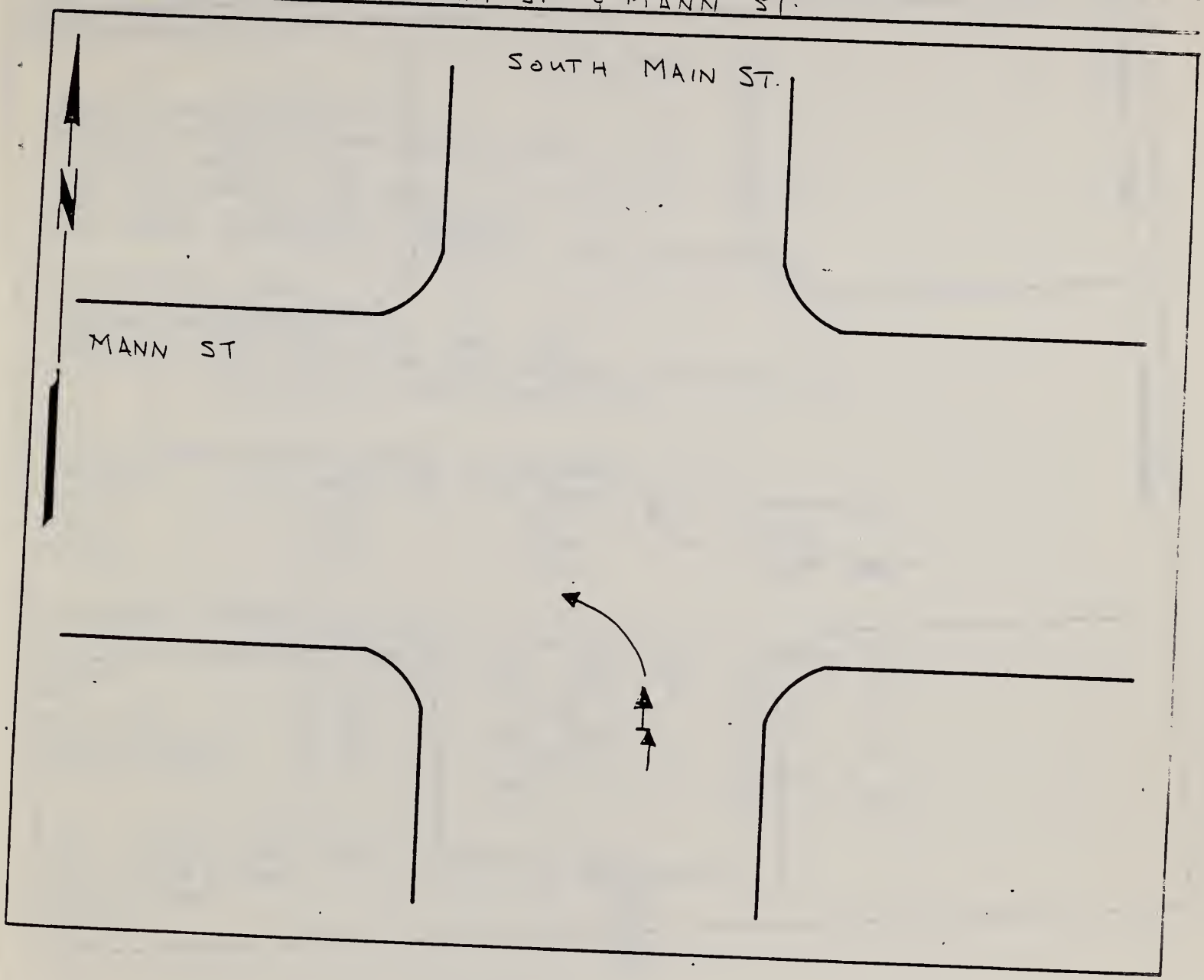
Appendix B-5

ACCIDENT DIAGRAM

TOWN BELLINGHAM

DATE 7/31/85 to 12/31/85

INTERSECTION SOUTH MAIN ST & MANN ST.



LEGEND

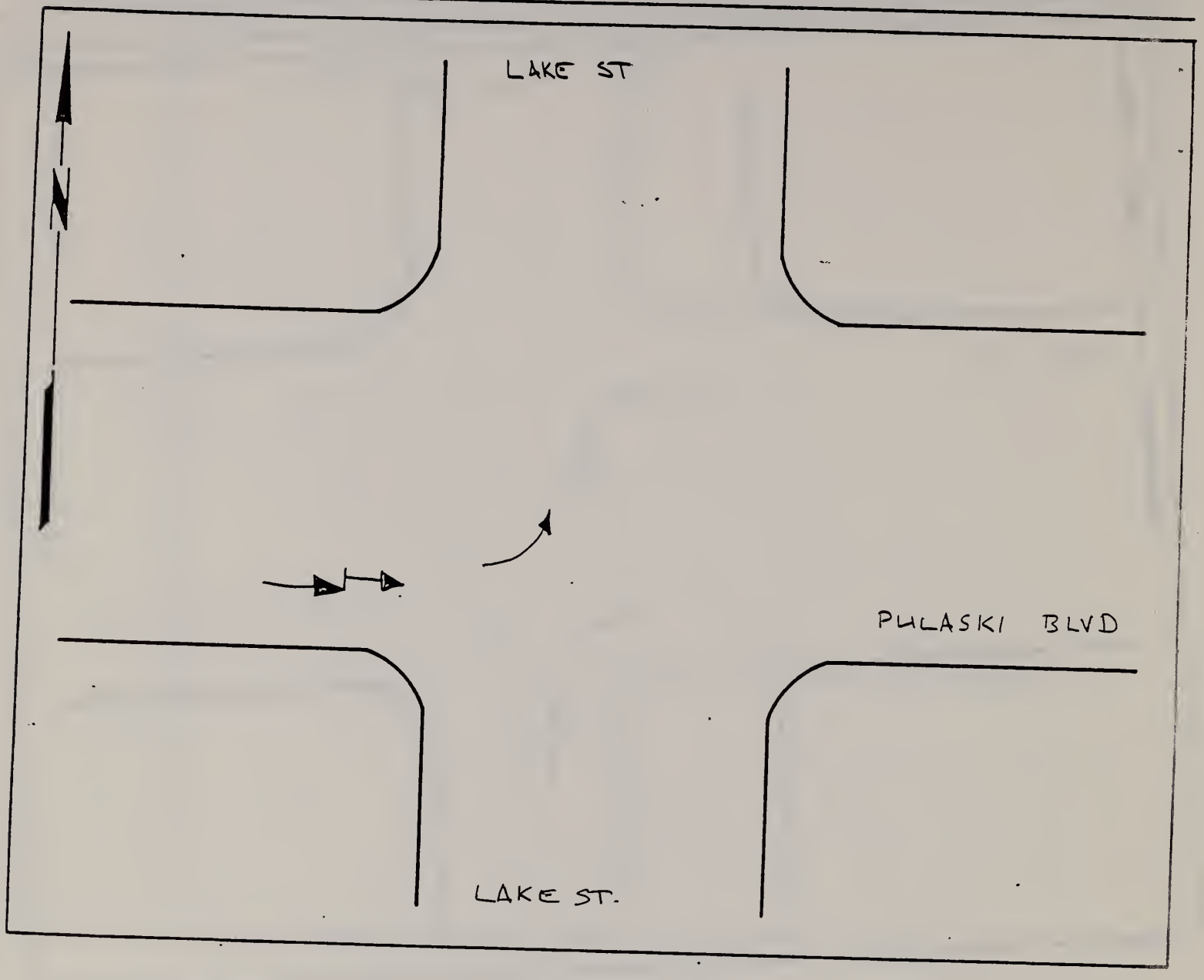
	Head On
	Rear End
	Angle
	Backing

	Fixed Object
	Lost Control
	Pedestrian
	Parked Vehicle

ACCIDENT DIAGRAM

TOWN BELLINGHAM DATE 7/31/85 to 12/31/85

INTERSECTION PULASKI BLVD & LAKE ST.



LEGEND

→ ←	Head On	□ ←	Fixed Object
← | ←	Rear End	← o	Lost Control
↓ ←	Angle	○ ←	Pedestrian
← → | ←	Backing	▨	Parked Vehicle

DATE:07-01-1986 TIME:08:17:09
bellmend

LAST DATASETS LOADED OR SAVED
VOLUME= GEOMETRICS=
KEY: A- -B
|
C

GENERAL CHARACTERISTICS
POPULATION GREATER THAN 250,000: NO
CONTROLS: FROM C: STOP
PREVAILING SPEED: 30 MPH
MAIN STREET # OF LANES: 2 LANES
MAIN STREET APPROACH A - EXCLUSIVE RIGHT TURN LANE: Y

MINOR STREET LANES
APPROACH: C: Mendon St.
SHARED LEFT AND RIGHT TURN LANE: YES
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

SIGHT DISTANCE RESTRICTIONS (in seconds)

APPROACH	A: North Main	B: North Main	C: Mendon St.
LEFTS	0.00	0.00	0.00
THRUS	0.00	0.00	0.00
RIGHTS	0.00	0.00	0.00

APPROACH	A: North Main			B: North Main			C: Mendon St.		
	LT	TH	RT	LT	TH	RT	LT	TH	RT
VOLUME	0	472	33	313	336	0	32	0	587
PHF	0.80			0.87			0.83		
ADJ VOLUME	0	590	41	360	386	0	39	0	707
PERCENT GRADE	4.00			0.00			0.00		
PASS CAR/HR	0			396			42	0	778

STEP 1 RIGHT TURNS FROM C:Mendon St.

CONFLICTING FLOWS	295
CRITICAL GAPS	5.5
CAPACITY	792
ACTUAL CAPACITY	792

STEP 2 LEFT TURNS FROM B:North Main

CONFLICTING FLOWS	590
CRITICAL GAPS	5.0
CAPACITY	658
CAPACITY USED	60%
IMPEDANCE FACTOR	0.47
ACTUAL CAPACITY	658

1985 HCM - CHAPTER 10 : UNSIGNALIZED - 3 APPROACHES (PAGE 2 of 2)
DATE:07-01-1986 TIME:08:17:09
bellmend

STEP 3 LEFT TURNS FROM	C:Mendon St.
CONFLICTING FLOWS	1357
CRITICAL GAPS	6.5
CAPACITY	147
ACTUAL CAPACITY	69

SUMMARY OF LEVEL OF SERVICE BY MOVEMENT

MOVEMENT	DEMAND	CAPACITY	RESERVE	LOS	AVG DEL(SEC)	AVG QUEUE
LT FROM B:	396	658	262	C	13.73	1.51
ALL MOVES FROM C:	820	514	-307	E*	INFINITE	INFINITE

1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
Mendonpm
2p90

date:07-02-1986 time:08:30:43
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=belmenpm GEOMETRICS=blmnpmg SIGNAL=blmnpms2
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	32	0	587	0	1	0	0	12	0	40
WB	0	0	0	0	0	0	0	0	0	0
NB	313	336	0	0	1	0	0	12	0	40
SB	0	472	33	0	1	1	0	12	12	40

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.830	5	n	17.0	3
WB	0.0%	0.0%		0	0	.000	0		17.0	0
NB	0.0%	2.0%	N	0	0	.870	5	n	17.0	3
SB	5.0%	2.0%	N	0	0	.800	5	n	17.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*		*												*		37.2	5	P
2			*						*	*							72.8	5	P

CYCLE= 120.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	32	0	587	.830	39	0	707
WB	0	0	0	.000	0	0	0
NB	313	336	0	.870	360	386	0
SB	0	472	33	.800	0	590	41

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-RT	746	1	1.00	746	0.05	0.95
NB	LT-TH	746	1	1.00	746	0.48	0.00
SB	TH	590	1	1.00	590	0.00	0.00
SB	RT	41	1	1.00	41	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING VOLUME
	LT	TH	RT	LT	TH	RT	LT	TH	
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	590	41	100	100	61	0	1	615

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.770	0.893	1225
NB	LT-TH	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.479	853
SB	TH	1800	1	1.000	0.990	0.975	1.000	1.000	1.000	1.000	1.000	1738
SB	RT	1800	1	1.000	0.990	0.975	1.000	1.000	1.000	0.850	1.000	1477

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
NB	120	73	1	746	386	360	0.48	1	615	0.00

CALCULATIONS

NB 1600 0.542 48.232 0.491 0.482 24.521 0.518 2.146 2.293 0.479 0.479

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-RT	746	1225	0.61	0.31	380	1.96	*
NB	LT-TH	746	853	0.87	0.61	517	1.44	*
SB	TH	590	1738	0.34	0.61	1053	0.56	
SB	RT	41	1477	0.03	1.00	1477	0.03	

CYCLE=120.0 LOST=10.0 SUM V/S CRIT= 1.48 TOTAL V/C= 1.62

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-RT	1.96	0.31	120	55.44	380	1308.27	1.00	1363.71	F	291.1	847
NB	LT-TH	1.44	0.61	120	56.39	517	335.96	1.00	392.35	F	86.2	245
SB	TH	0.56	0.61	120	10.70	1053	0.52	1.00	11.22	B	7.7	6
SB	RT	0.03	1.00	120	0.00	1477	0.00	1.00	0.00	A	0.0	1

DIR Delay LOS
EB %1363.71 F
NB 392.35 F
SB 10.49 B
INTERSECTION DELAY =620.03 INTERSECTION LOS=F
optimal cycle length 120.0
suggested timing phase 1 is 45.1 secs green, 5.0 secs yellow + red clear
suggested timing phase 2 is 64.9 secs green, 5.0 secs yellow + red clear

2

1985 HCM - CHAPTER 10 : UNSIGNALIZED - 3 APPROACHES (PAGE 1 of 2)
DATE:07-03-1986 TIME:12:46:10
mainmend

LAST DATASETS LOADED OR SAVED
VOLUME=mendvol GEOMETRICS=mendgeo
KEY: A- -B
|
C

GENERAL CHARACTERISTICS
POPULATION GREATER THAN 250,000: NO
CONTROLS: FROM C: STOP
FROM C RT LANE: STOP
PREVAILING SPEED: 30 MPH
MAIN STREET # OF LANES: 2 LANES
MAIN STREET APPROACH A - EXCLUSIVE RIGHT TURN LANE: Y

MINOR STREET LANES
APPROACH: C: Mendon St
SHARED LEFT AND RIGHT TURN LANE: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: YES

SIGHT DISTANCE RESTRICTIONS (in seconds)

APPROACH	A: North Main	B: North Main	C: Mendon St
LEFTS	0.00	0.00	0.00
THRUS	0.00	0.00	0.00
RIGHTS	0.00	0.00	0.00

APPROACH	A: North Main			B: North Main			C: Mendon St		
	LT	TH	RT	LT	TH	RT	LT	TH	RT
VOLUME	0	472	33	313	336	0	32	0	587
PHF	0.80			0.87			0.83		
ADJ VOLUME	0	590	41	360	386	0	39	0	707
PERCENT GRADE	4.00			0.00			0.00		
PASS CAR/HR	0			396			42	0	778

STEP 1 RIGHT TURNS FROM C:Mendon St

CONFLICTING FLOWS	295
CRITICAL GAPS	4.5
CAPACITY	1030
ACTUAL CAPACITY	1030

STEP 2 LEFT TURNS FROM B:North Main

CONFLICTING FLOWS	590
CRITICAL GAPS	5.0
CAPACITY	658
CAPACITY USED	60%
IMPEDANCE FACTOR	0.47
ACTUAL CAPACITY	658

1985 HCM - CHAPTER 10 : UNSIGNALIZED - 3 APPROACHES (PAGE 2 of 2)
DATE:07-03-1986 TIME:12:46:10
mainmend

STEP 3 LEFT TURNS FROM	C:Mendon St
CONFLICTING FLOWS	1357
CRITICAL GAPS	6.5
CAPACITY	147
ACTUAL CAPACITY	69

SUMMARY OF LEVEL OF SERVICE BY MOVEMENT

MOVEMENT	DEMAND	CAPACITY	RESERVE	LOS	AVG DEL(SEC)	AVG QUEUE
LT FROM B:	396	658	262	C	13.73	1.51
LT FROM C:	42	69	27	E	135.34	14.88
RT FROM C:	778	1030	252	C	14.31	0.17

1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
Mendonpm
2p90
date:07-02-1986 time:09:10:45
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=belmenpm GEOMETRICS=blmnpmg3 SIGNAL=blmnpms5
LOCATED IN CBD:n

VOLUME & GEOMETRICS

DIR	VOLUMES LT	TH	RT	# OF LANES LT	TH	RT	LANE WIDTH LT	TH	RT	CURB TO CURB
EB	32	0	587	1	1	0	12	12	0	40
WB	0	0	0	0	0	0	0	0	0	0
NB	313	336	0	1	1	0	12	12	0	40
SB	0	472	33	0	1	1	0	12	12	40

TRAFFIC & ROADWAY CONDITIONS

DIR	GRADE	%HV	ADJ PARK Y/N	MOVES	BUSES	PHF	PEDESTRIANS CROSS	BUT	MIN TIME	ARR TYPE
EB	0.0%	2.0%	N	0	0	.830	5	n	17.0	3
WB	0.0%	0.0%		0	0	.000	0		17.0	0
NB	0.0%	2.0%	N	0	0	.870	5	n	17.0	3
SB	5.0%	2.0%	N	0	0	.800	5	n	17.0	3

PHASINGS

	EASTBOUND l	t	r	p	WESTBOUND l	t	r	p	NORTHBOUND l	t	r	p	SOUTHBOUND l	t	r	p	GREEN	Y+R	PRE/ACT
1	*		*																
2			*						*	*					*		2.6	5	A
														*	*		47.4	5	A

CYCLE= 60.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	32	0	587	.830	39	0	707
WB	0	0	0	.000	0	0	0
NB	313	336	0	.870	360	386	0
SB	0	472	33	.800	0	590	41

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	39	1	1.00	39	1.00	0.00
EB	TH-RT	707	1	1.00	707	0.00	1.00
NB	LT	360	1	1.00	360	1.00	0.00
NB	TH	386	1	1.00	386	0.00	0.00
SB	TH	590	1	1.00	590	0.00	0.00
SB	RT	41	1	1.00	41	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES LT	TH	RT	% IN PHASE WITH LEFT LT	TH	RT	# LANES LT	TH	OPPOSING VOLUME
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	590	41	100	100	79	0	1	623

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.850	1515
EB	TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.763	1.000	1359
NB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.456	812
NB	TH	1800	1	1.000	0.990	0.975	1.000	1.000	1.000	1.000	1.000	1782
SB	TH	1800	1	1.000	0.990	0.975	1.000	1.000	1.000	0.850	1.000	1738
SB	RT	1800	1	1.000	0.990	0.975	1.000	1.000	1.000	1.000	1.000	1477

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
NB	60	47	1	360	386	360	1.00	1	623	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
NB	1800	0.346	40.748	0.486	1.000	6.659	0.000	0.000	2.315	0.456	0.456

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	39	1515	0.03	0.04	65	0.59	*
EB	TH-RT	707	1359	0.52	0.00	0	0.00	
NB	LT	360	812	0.44	0.79	642	0.56	*
NB	TH	386	1782	0.22	0.79	1408	0.27	
SB	TH	590	1738	0.34	0.79	1373	0.43	
SB	RT	41	1477	0.03	1.00	1477	0.03	

CYCLE= 60.0 LOST=10.0 SUM V/S CRIT= 0.47 TOTAL V/C= 0.56

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	0.59	0.04	60	21.42	65	8.90	1.00	30.32	D	0.6	2
EB	TH-RT	0.00	0.00	60	0.00	0	0.00	0.00	0.00	A	11.8	1
NB	LT	0.56	0.79	60	1.80	642	0.85	1.00	2.65	A	1.3	1
NB	TH	0.27	0.79	60	1.28	1408	0.03	0.85	1.11	A	1.4	1
SB	TH	0.43	0.79	60	1.52	1373	0.14	0.85	1.41	A	2.1	1
SB	RT	0.03	1.00	60	0.00	1477	0.00	0.85	0.00	A	0.0	1

DIR	Delay	LOS
EB	1.57	A
NB	1.86	A
SB	1.32	A

INTERSECTION DELAY = 1.60 INTERSECTION LOS=A
optimal cycle length 60.0
suggested timing phase 1 is 2.7 secs green, 5.0 secs yellow + red clear
suggested timing phase 2 is 47.3 secs green, 5.0 secs yellow + red clear

1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
Mendon AM
am 60
date:07-03-1986 time:13:02:23
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=menvolam GEOMETRICS=blmnpmg3 SIGNAL=blmnpms5
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	14	0	248	1	1	0	12	12	0	40
WB	0	0	0	0	0	0	0	0	0	0
NB	228	610	0	1	1	0	12	12	0	40
SB	0	284	17	0	1	1	0	12	12	40

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.710	5	n	17.0	3
WB	0.0%	0.0%		0	0	.000	0		17.0	0
NB	0.0%	2.0%	N	0	0	.850	5	n	17.0	3
SB	5.0%	2.0%	N	0	0	.770	5	n	17.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*		*												*		2.6	5	A
2			*						*	*					*		47.4	5	A

CYCLE= 60.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	14	0	248	.710	20	0	349
WB	0	0	0	.000	0	0	0
NB	228	610	0	.850	268	718	0
SB	0	284	17	.770	0	369	22

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	20	1	1.00	20	1.00	0.00
EB	TH-RT	349	1	1.00	349	0.00	1.00
NB	LT	268	1	1.00	268	1.00	0.00
NB	TH	718	1	1.00	718	0.00	0.00
SB	TH	369	1	1.00	369	0.00	0.00
SB	RT	22	1	1.00	22	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN	OPPOSING APPROACH								
BEING OPPOSED	VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	VOLUME
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	369	22	100	100	79	0	1	386

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.850	1515
EB	TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.763	1.000	1359
NB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.607	1081
NB	TH	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	1.000	1782
SB	TH	1800	1	1.000	0.990	0.975	1.000	1.000	1.000	1.000	1.000	1738
SB	RT	1800	1	1.000	0.990	0.975	1.000	1.000	1.000	0.850	1.000	1477

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

Appendix C-4b (con't)

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
NB	60	47	1	268	718	268	1.00	1	386	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
NB	1800	0.215	43.966	0.634	1.000	3.441	0.000	0.000	1.776	0.607	0.607

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	20	1515	0.01	0.04	65	0.30	*
EB	TH-RT	349	1359	0.26	0.00	0	0.00	
NB	LT	268	1081	0.25	0.79	854	0.31	
NB	TH	718	1782	0.40	0.79	1408	0.51	*
SB	TH	369	1738	0.21	0.79	1373	0.27	
SB	RT	22	1477	0.01	1.00	1477	0.01	

CYCLE= 60.0 LOST=10.0 SUM V/S CRIT= 0.42 TOTAL V/C= 0.50

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	0.30	0.04	60	21.15	65	0.80	1.00	21.94	C	0.3	1
EB	TH-RT	0.00	0.00	60	0.00	0	0.00	0.00	0.00	A	5.8	1
NB	LT	0.31	0.79	60	1.34	854	0.07	1.00	1.41	A	0.9	1
NB	TH	0.51	0.79	60	1.68	1408	0.26	0.85	1.65	A	2.5	2
SB	TH	0.27	0.79	60	1.27	1373	0.03	0.85	1.11	A	1.3	1
SB	RT	0.01	1.00	60	0.00	1477	0.00	0.85	0.00	A	0.0	1

DIR	Delay	LOS
EB	1.17	A
NB	1.59	A
SB	1.04	A

INTERSECTION DELAY = 1.38 INTERSECTION LOS=A

optimal cycle length 60.0

suggested timing phase 1 is 1.6 secs green, 5.0 secs yellow + red clear

suggested timing phase 2 is 48.4 secs green, 5.0 secs yellow + red clear

1985 HCM - CHAPTER 10 : UNSIGNALIZED - 3 APPROACHES (PAGE 1 of 2)
DATE:07-03-1986 TIME:07:58:30
Main @ Mechanic PM Peak

LAST DATASETS LOADED OR SAVED
VOLUME=mainmech GEOMETRICS=mainmech
KEY: A- -B
!
C

GENERAL CHARACTERISTICS
POPULATION GREATER THAN 250,000: NO
CONTROLS: FROM C: STOP
FROM C RT LANE: YIELD
PREVAILING SPEED: 30 MPH
MAIN STREET # OF LANES: 2 LANES
MAIN STREET APPROACH A - EXCLUSIVE RIGHT TURN LANE: N

MINOR STREET LANES
APPROACH: C: Main St
SHARED LEFT AND RIGHT TURN LANE: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: YES
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

SIGHT DISTANCE RESTRICTIONS (in seconds)

APPROACH	A: Main (Rte 1	B: Mechanic St	C: Main St
LEFTS	0.00	0.00	0.00
THRUS	0.00	0.00	0.00
RIGHTS	0.00	0.00	1.00

APPROACH	A: Main (Rte 1			B: Mechanic St			C: Main St		
	LT	TH	RT	LT	TH	RT	LT	TH	RT
VOLUME	0	289	778	13	331	0	312	0	7
PHF	0.93			0.83			0.96		
ADJ VOLUME	0	311	837	16	399	0	325	0	7
PERCENT GRADE	0.00			3.00			0.00		
PASS CAR/HR	0			24			358	0	8

STEP 1 RIGHT TURNS FROM C:Main St

CONFLICTING FLOWS	729
CRITICAL GAPS	5.5
CAPACITY	478
ACTUAL CAPACITY	478

STEP 2 LEFT TURNS FROM B:Mechanic St

CONFLICTING FLOWS	1147
CRITICAL GAPS	5.0
CAPACITY	365
CAPACITY USED	7%
IMPEDANCE FACTOR	0.96
ACTUAL CAPACITY	365

STEP 3 LEFT TURNS FROM	C:Main St	
CONFLICTING FLOWS		1143
CRITICAL GAPS		6.5
CAPACITY		197
ACTUAL CAPACITY		189

SUMMARY OF LEVEL OF SERVICE BY MOVEMENT

MOVEMENT	DEMAND	CAPACITY	RESERVE	LOS	AVG DEL(SEC)	AVG QUEUE
LT FROM B:	24	365	341	B	10.55	0.07
LT FROM C:	358	189	-168	E*	INFINITE	INFINITE
RT FROM C:	8	478	470	A	7.65	0.76

1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
Main @ Mech
pm peak
date:07-03-1986 time:08:28:59
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=mech1 GEOMETRICS=mech1 SIGNAL=mech1
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	312	0	7	1	0	1	13	0	12	28
WB	0	0	0	0	0	0	0	0	0	0
NB	13	331	0	0	1	0	0	13	0	28
SB	0	289	778	0	1	0	0	13	0	28

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK				PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.960	5	n	14.0	3
WB	0.0%	0.0%		0	0	.000	0		14.0	0
NB	3.0%	2.0%	N	0	0	.900	5	n	14.0	3
SB	0.0%	2.0%	N	0	0	.930	5	n	14.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*		*																
2			*						*	*					*		23.1	5	P
													*	*			86.9	5	P

CYCLE= 120.0

VOLUME ADJUSTMENT WORKSHEET

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	312	0	7	.960	325	0	7
WB	0	0	0	.000	0	0	0
NB	13	331	0	.900	14	368	0
SB	0	289	778	.930	0	311	837

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	325	1	1.00	325	1.00	0.00
EB	RT	7	1	1.00	7	0.00	1.00
NB	LT-TH	382	1	1.00	382	0.04	0.00
SB	TH-RT	1147	1	1.00	1147	0.00	0.73

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING VOLUME
	LT	TH	RT	LT	TH	RT	LT	TH	
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	311	837	100	100	72	0	1	916

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	0.850	1565
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
NB	LT-TH	1800	1	1.033	0.990	0.985	1.000	1.000	1.000	1.000	0.856	1552
SB	TH-RT	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	0.800	1.000	1473

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
NB	120	87	1	382	368	14	0.04	1	916	0.00

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Gq	Pt	Gf	El	Fm	Flt
NB	1800	0.509	52.484	0.302	0.038	34.366	0.962	24.655	3.721	0.856	0.856

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	325	1565	0.21	0.19	302	1.08	*
EB	RT	7	1515	0.00	1.00	1515	0.00	
NB	LT-TH	382	1552	0.25	0.72	1123	0.34	
SB	TH-RT	1147	1473	0.78	0.72	1066	1.08	*

CYCLE=120.0 LOST=10.0 SUM V/S CRIT= 0.99 TOTAL V/C= 1.08

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	1.08	0.19	120	37.49	302	65.50	1.00	102.99	F	13.7	29
EB	RT	0.00	1.00	120	0.00	1515	0.00	1.00	0.00	A	0.0	1
NB	LT-TH	0.34	0.72	120	4.62	1123	0.07	1.00	4.69	A	3.5	2
SB	TH-RT	1.08	0.72	120	15.74	1066	44.97	1.00	60.71	F	24.6	59

DIR	Delay	LOS
EB	100.73	F
NB	4.69	A
SB	60.71	F

INTERSECTION DELAY = 56.35 INTERSECTION LOS=E

THE EXISTING TIMING IS OPTIMAL

Main @ Mech
pm peak
date:07-11-1986 time:08:00:30
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=mech1 GEOMETRICS=mech2 SIGNAL=mech3
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	312	0	7	1	0	1	13	0	12	28
WB	0	0	0	0	0	0	0	0	0	0
NB	13	331	0	0	1	0	0	13	0	28
SB	0	289	778	0	1	1	0	13	12	40

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.960	5	n	17.0	3
WB	0.0%	0.0%		0	0	.000	0		17.0	0
NB	3.0%	2.0%	N	0	0	.900	5	n	14.0	3
SB	0.0%	2.0%	N	0	0	.930	5	n	14.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*		*												*		6.8	5	P
2			*						*	*					*		6.2	5	P

CYCLE= 23.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	312	0	7	.960	325	0	7
WB	0	0	0	.000	0	0	0
NB	13	331	0	.900	14	368	0
SB	0	289	778	.930	0	311	837

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	325	1	1.00	325	1.00	0.00
EB	RT	7	1	1.00	7	0.00	1.00
NB	LT-TH	382	1	1.00	382	0.04	0.00
SB	TH	311	1	1.00	311	0.00	0.00
SB	RT	837	1	1.00	837	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	VOLUME
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	311	837	100	100	27	0	1	537

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	For	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	0.850	1565
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
NB	LT-TH	1800	1	1.033	0.990	0.985	1.000	1.000	1.000	1.000	1.257	2281
SB	TH	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	1.000	1842
SB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES

NB 2 0 1 382 368 14 0.04 1 537 0.00

CALCULATIONS

DIR	Sod	Yo	Gu	Fs	Pl	Gd	Pt	Gf	El	Fm	Flt
NB	1800	0.299	0.000	0.539	0.038	6.233	0.962	5.761	2.087	1.000	1.257

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	325	1565	0.21	0.29	461	0.71	
EB	RT	7	1515	0.00	1.00	1515	0.00	
NB	LT-TH	382	2281	0.17	0.27	618	0.62	
SB	TH	311	1842	0.17	0.27	499	0.62	
SB	RT	837	1515	0.55	1.00	1515	0.55	*

CYCLE= 23.0 LOST= 5.0 SUM V/S CRIT= 0.55 TOTAL V/C= 0.71

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	0.71	0.29	23	5.49	461	3.36	1.00	8.86	B	1.5	3
EB	RT	0.00	1.00	23	0.00	1515	0.00	1.00	0.00	A	0.0	1
NB	LT-TH	0.62	0.27	23	5.58	618	1.35	1.00	6.93	B	1.8	3
SB	TH	0.62	0.27	23	5.59	499	1.72	1.00	7.30	B	1.4	3
SB	RT	0.55	1.00	23	0.00	1515	0.34	1.00	0.34	A	0.1	1

DIR	Delay	LOS
EB	8.66	B
NB	6.93	B
SB	2.23	A

INTERSECTION DELAY = 4.34 INTERSECTION LOS=A

THE EXISTING TIMING IS OPTIMAL

1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
Main @ Mech
am peak
date:07-11-1986 time:08:03:49
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=mech2 GEOMETRICS=mech2 SIGNAL=mech3
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	667	0	4	1	0	1	13	0	12	28
WB	0	0	0	0	0	0	0	0	0	0
NB	11	194	0	0	1	0	0	13	0	28
SB	0	283	245	0	1	1	0	13	12	40

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N		0	.960	5	n	17.0	3
WB	0.0%	0.0%			0	.000	0		17.0	0
NB	3.0%	2.0%	N		0	.780	5	n	14.0	3
SB	0.0%	2.0%	N		0	.780	5	n	14.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*		*												*		6.8	5	F
2			*						*	*					*		6.2	5	F

CYCLE= 23.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	667	0	4	.960	695	0	4
WB	0	0	0	.000	0	0	0
NB	11	194	0	.780	14	249	0
SB	0	283	245	.780	0	363	314

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	695	1	1.00	695	1.00	0.00
EB	RT	4	1	1.00	4	0.00	1.00
NB	LT-TH	263	1	1.00	263	0.05	0.00
SB	TH	363	1	1.00	363	0.00	0.00
SB	RT	314	1	1.00	314	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING VOLUME
	LT	TH	RT	LT	TH	RT	LT	TH	
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	363	314	100	100	27	0	1	448

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	0.850	1565
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
NB	LT-TH	1800	1	1.033	0.990	0.985	1.000	1.000	1.000	1.000	1.246	2260
SB	TH	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	1.000	1842
SB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES

CALCULATIONS

DIR	Sop	Yo	Gu	Fs	Pl	Ga	Pt	Gf	El	Fm	Flt
NB	1800	0.249	0.678	0.595	0.054	5.555	0.946	5.010	1.891	1.000	1.246

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	695	1565	0.44	0.29	461	1.51	*
EB	RT	4	1515	0.00	1.00	1515	0.00	
NB	LT-TH	263	2260	0.12	0.27	612	0.43	
SB	TH	363	1842	0.20	0.27	499	0.73	*
SB	RT	314	1515	0.21	1.00	1515	0.21	

CYCLE= 23.0 LOST=10.0 SUM V/S CRIT= 0.64 TOTAL V/C= 1.13

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	1.51	0.29	23	7.83	461	419.75	1.00	427.58	F	84.1	248
EB	RT	0.00	1.00	23	0.00	1515	0.00	1.00	0.00	A	0.0	1
NB	LT-TH	0.43	0.27	23	5.26	612	0.31	1.00	5.57	B	1.2	2
SB	TH	0.73	0.27	23	5.78	499	3.64	1.00	9.42	B	1.8	4
SB	RT	0.21	1.00	23	0.00	1515	0.01	1.00	0.01	A	0.0	1

DIR	Delay	LOS
EB	425.03	F
NB	5.57	B
SB	5.06	B

INTERSECTION DELAY =184.27 INTERSECTION LOS=F

optimal cycle length 48.0

suggested timing phase 1 is 26.3 secs green. 5.0 secs yellow + red clear

suggested timing phase 2 is 11.7 secs green. 5.0 secs yellow + red clear

Main @ Mech
am peak
date:07-11-1986 time:07:54:54
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=mech2 GEOMETRICS=mech2 SIGNAL=
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	667	0	4	1	0	1	13	0	12	28
WB	0	0	0	0	0	0	0	0	0	0
NB	11	194	0	0	1	0	0	13	0	28
SB	0	283	245	0	1	1	0	13	12	40

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK				PEDESTRIANS			ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.960	5	n	17.0	3
WB	0.0%	0.0%		0	0	.000	0		17.0	0
NB	3.0%	2.0%	N	0	0	.780	5	n	14.0	3
SB	0.0%	2.0%	N	0	0	.780	5	n	14.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	o	l	t	r	o	l	t	r	o	l	t	r	o			
1	*		*												*		27.0	5	P
2			*						*	*					*		12.0	5	P

CYCLE= 49.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	667	0	4	.960	695	0	4
WB	0	0	0	.000	0	0	0
NB	11	194	0	.780	14	249	0
SB	0	283	245	.780	0	363	314

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	695	1	1.00	695	1.00	0.00
EB	RT	4	1	1.00	4	0.00	1.00
NB	LT-TH	263	1	1.00	263	0.05	0.00
SB	TH	363	1	1.00	363	0.00	0.00
SB	RT	314	1	1.00	314	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING VOLUME
	LT	TH	RT	LT	TH	RT	LT	TH	
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	363	314	100	100	24	0	1	440

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	For	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	0.850	1565
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
NB	LT-TH	1800	1	1.033	0.990	0.985	1.000	1.000	1.000	1.000	1.005	1822
SB	TH	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	1.000	1842
SB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES

CALCULATIONS

DIR	Sob	Yo	Gu	Fs	Fl	Ga	Pt	Gf	El	Fm	Flt
NB	1800	0.244	0.039	0.600	0.054	11.961	0.946	9.910	1.874	1.000	1.005

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	695	1565	0.44	0.55	863	0.81	*
EB	RT	4	1515	0.00	1.00	1515	0.00	
NB	LT-TH	263	1822	0.14	0.24	446	0.59	
SB	TH	363	1842	0.20	0.24	451	0.80	*
SB	RT	314	1515	0.21	1.00	1515	0.21	

CYCLE= 49.0 LOST=10.0 SUM V/S CRIT= 0.64 TOTAL V/C= 0.81

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	0.81	0.55	49	6.75	863	3.95	1.00	10.70	B	4.2	7
EB	RT	0.00	1.00	49	0.00	1515	0.00	1.00	0.00	A	0.0	1
NB	LT-TH	0.59	0.24	49	12.41	446	1.50	1.00	13.90	B	2.7	4
SB	TH	0.80	0.24	49	13.22	451	7.04	1.00	20.26	C	3.9	7
SB	RT	0.21	1.00	49	0.00	1515	0.01	1.00	0.01	A	0.0	1

DIR	Delay	LOS
EB	10.64	B
NB	13.90	B
SB	10.86	B

INTERSECTION DELAY = 11.26 INTERSECTION LOS=B

optimal cycle length 49.0

suggested timing phase 1 is 27.0 secs green. 5.0 secs yellow + red clear

suggested timing phase 2 is 12.0 secs green. 5.0 secs yellow + red clear

Main @ Mech
pm peak
date:07-11-1986 time:07:49:22
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=mech1 GEOMETRICS=mech2 SIGNAL=
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	312	0	7	1	0	1	13	0	12	28
WB	0	0	0	0	0	0	0	0	0	0
NB	13	331	0	0	1	0	0	13	0	28
SB	0	289	778	0	1	1	0	13	12	40

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.960	5	n	17.0	3
WB	0.0%	0.0%		0	0	.000	0		17.0	0
NB	3.0%	2.0%	N	0	0	.900	5	n	14.0	3
SB	0.0%	2.0%	N	0	0	.930	5	n	14.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*		*												*		16.5	5	P
2			*						*	*					*		22.5	5	P

CYCLE= 49.0

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	312	0	7	.960	325	0	7
WB	0	0	0	.000	0	0	0
NB	13	331	0	.900	14	368	0
SB	0	289	778	.930	0	311	837

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT	325	1	1.00	325	1.00	0.00
EB	RT	7	1	1.00	7	0.00	1.00
NB	LT-TH	382	1	1.00	382	0.04	0.00
SB	TH	311	1	1.00	311	0.00	0.00
SB	RT	837	1	1.00	837	0.00	1.00

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING VOLUME
	LT	TH	RT	LT	TH	RT	LT	TH	
EASTBOUND	0	0	0	100	100	100	0	0	0
NORTHBOUND	0	311	837	100	100	46	0	1	695

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	0.850	1565
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
NB	LT-TH	1800	1	1.033	0.990	0.985	1.000	1.000	1.000	1.000	0.959	1739
SB	TH	1800	1	1.033	0.990	1.000	1.000	1.000	1.000	1.000	1.000	1842
SB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT
INPUT VARIABLES

DIR	G	P	N	Vo	Vm	Vlt	Plt	No	Vo Plt o

CALCULATIONS

DIR	Sob	Yo	Gu	Fs	Pl	Ga	Pt	Gf	El	Fm	Flt
NB	1800	0.386	5.837	0.441	0.038	16.663	0.962	13.981	2.553	0.959	0.959

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT	325	1565	0.21	0.34	527	0.62	
EB	RT	7	1515	0.00	1.00	1515	0.00	
NB	LT-TH	382	1739	0.22	0.46	799	0.48	
SB	TH	311	1842	0.17	0.46	846	0.37	
SB	RT	837	1515	0.55	1.00	1515	0.55	*

CYCLE= 49.0 LOST= 5.0 SUM V/S CRIT= 0.55 TOTAL V/C= 0.61

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT	0.62	0.34	49	10.34	527	1.56	1.00	11.89	B	2.9	4
EB	RT	0.00	1.00	49	0.00	1515	0.00	1.00	0.00	A	0.0	1
NB	LT-TH	0.48	0.46	49	6.98	799	0.36	1.00	7.34	B	2.8	3
SB	TH	0.37	0.46	49	6.55	846	0.13	1.00	6.68	B	2.3	2
SB	RT	0.55	1.00	49	0.00	1515	0.34	1.00	0.34	A	0.1	1

DIR	Delay	LOS
EB	11.63	B
NB	7.34	B
SB	2.06	A

INTERSECTION DELAY = 4.85 INTERSECTION LOS=A

optimal cycle length 49.0

suggested timing phase 1 is 16.5 secs green. 5.0 secs yellow + red clear

suggested timing phase 2 is 22.5 secs green. 5.0 secs yellow + red clear

1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 1 OF 2)
DATE:01-01-1980 TIME:00:31:17
Hartford Ave - North Main - Cedar Hill

LAST DATASETS LOADED OR SAVED
VOLUME=hartam GEOMETRICS=hart1
KEY: D
|
A- -B
|
C

GENERAL CHARACTERISTICS
POPULATION GREATER THAN 250.000: NO
CONTROLS: FROM C: STOP
FROM C RT LANE: STOP
FROM D: STOP
PREVAILING SPEED: 30 MPH
MAIN STREET # OF LANES: 4 LANES
MAIN STREET APPROACH A - EXCLUSIVE RIGHT TURN LANE: YES
MAIN STREET APPROACH B - EXCLUSIVE RIGHT TURN LANE: NO

MINOR STREET LANES

APPROACH: C: North Main
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: YES
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

APPROACH: D: Cedar Hill
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

SIGHT DISTANCE RESTRICTIONS (in seconds)

APPROACH	A: Hartford Av	B: Hartford Av	C: North Main	D: Cedar Hill
LEFTS	0.00	0.00	0.00	0.00
THRUS	0.00	0.00	0.00	0.00
RIGHTS	0.00	0.00	0.00	0.00

APPROACH	A: Hartford Av			B: Hartford Av			C: North Main			D: Cedar Hill		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
VOLUME	1	544	26	16	182	179	28	18	737	28	7	1
PHF	0.87			0.83			0.90			0.64		
ADJ VOLUME	1	625	30	19	219	216	31	20	819	44	11	2
PERCENT GRADE	0.00			0.00			0.00					
PASS CAR/HR	1			21			34	22	901	48	12	2

STEP 1 RIGHT TURNS FROM	C:North Main	D:Cedar Hill
CONFLICTING FLOWS	313	217
CRITICAL GAPS	5.5	5.5
CAPACITY	776	866
CAPACITY USED	116%	0%
IMPEDANCE FACTOR	0.00	1.00
ACTUAL CAPACITY	776	866

1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 2 OF 2)
DATE:01-01-1980 TIME:00:31:17
Hartford Ave - North Main - Cedar Hill

STEP 2 LEFT TURNS FROM	B:Hartford Ave	A:Hartford Ave
CONFLICTING FLOWS	625	435
CRITICAL GAPS	5.5	5.5
CAPACITY	540	673
CAPACITY USED	4%	0%
IMPEDANCE FACTOR	0.98	1.00
ACTUAL CAPACITY	540	673

STEP 3 THRU MOVES FROM	C:North Main	D:Cedar Hill
CONFLICTING FLOWS	1081	973
CRITICAL GAPS	6.5	6.5
CAPACITY	214	248
CAPACITY USED	10%	5%
IMPEDANCE FACTOR	0.94	0.97
ACTUAL CAPACITY	210	243

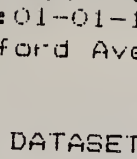
STEP 4 LEFT TURNS FROM	C:North Main	D:Cedar Hill
CONFLICTING FLOWS	1093	1812
CRITICAL GAPS	7.0	7.0
CAPACITY	174	60
ACTUAL CAPACITY	166	0

SUMMARY OF LEVEL OF SERVICE BY MOVEMENT

MOVEMENT	DEMAND	CAPACITY	RESERVE	LOS	AVG DEL(SEC)	AVG QUE
LT FROM A:	1	673	672	A	5.36	0.00
LT FROM B:	21	540	518	A	6.95	0.04
RT FROM C:	901	776	-125	E*	INFINITE	INFINITE
SHARED LT/TH FROM C:	56	181	125	D	28.87	0.45
ALL MOVES FROM D:	62	0	-62	E*	INFINITE	INFINITE

1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 1 OF 2)
DATE:01-01-1980 TIME:00:29:44
Hartford Ave - North Main - Cedar Hill

LAST DATASETS LOADED OR SAVED
VOLUME=hartom GEOMETRICS=hart1
KEY:



GENERAL CHARACTERISTICS
POPULATION GREATER THAN 250.000: NO
CONTROLS: FROM C: STOP
FROM C RT LANE: STOP
FROM D: STOP
PREVAILING SPEED: 30 MPH
MAIN STREET # OF LANES: 4 LANES
MAIN STREET APPROACH A - EXCLUSIVE RIGHT TURN LANE: YES
MAIN STREET APPROACH B - EXCLUSIVE RIGHT TURN LANE: NO

MINOR STREET LANES

APPROACH: C: North Main
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: YES
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

APPROACH: D: Cedar Hill
EXCLUSIVE LEFT TURN LANES: NO
EXCLUSIVE RIGHT TURN LANES: NO
LARGE RIGHT TURN RADIUS OR SHALLOW RIGHT TURN ANGLE: NO
RIGHT TURN ACCELERATION LANE ON MAJOR: NO

SIGHT DISTANCE RESTRICTIONS (in seconds)

APPROACH	A: Hartford Av	B: Hartford Av	C: North Main	D: Cedar Hill
LEFTS	0.00	0.00	0.00	0.00
THRUS	0.00	0.00	0.00	0.00
RIGHTS	0.00	0.00	0.00	0.00

APPROACH	A: Hartford Av			B: Hartford Av			C: North Main			D: Cedar Hill		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
VOLUME	3	184	65	699	476	9	56	12	275	9	12	1
PHF	0.94			0.95			0.93			0.61		
ADJ VOLUME	3	196	69	736	501	9	60	13	296	15	20	2
PERCENT GRADE	0.00			0.00			0.00					
PASS CAR/HR	4			809			66	14	325	16	22	2

STEP 1 RIGHT TURNS FROM	C:North Main	D:Cedar Hill
CONFLICTING FLOWS	98	255
CRITICAL GAPS	5.5	5.5
CAPACITY	995	829
CAPACITY USED	33%	0%
IMPEDANCE FACTOR	0.75	1.00
ACTUAL CAPACITY	995	829

1985 HCM - CHAPTER 10: UNSIGNALIZED - 4 APPROACHES (PAGE 2 OF 2)
DATE:01-01-1980 TIME:00:29:44
Hartford Ave - North Main - Cedar Hill

STEP 2 LEFT TURNS FROM	B:Hartford Ave	A:Hartford Ave
CONFLICTING FLOWS	196	511
CRITICAL GAPS	5.5	5.5
CAPACITY	888	616
CAPACITY USED	91%	1%
IMPEDANCE FACTOR	0.13	1.00
ACTUAL CAPACITY	888	616

STEP 3 THRU MOVES FROM	C:North Main	D:Cedar Hill
CONFLICTING FLOWS	1445	1441
CRITICAL GAPS	6.5	6.5
CAPACITY	130	131
CAPACITY USED	87%	132%
IMPEDANCE FACTOR	0.17	0.00
ACTUAL CAPACITY	16	16

STEP 4 LEFT TURNS FROM	C:North Main	D:Cedar Hill
CONFLICTING FLOWS	1467	1749
CRITICAL GAPS	7.0	7.0
CAPACITY	100	66
ACTUAL CAPACITY	0	1

SUMMARY OF LEVEL OF SERVICE BY MOVEMENT

MOVEMENT	DEMAND	CAPACITY	RESERVE	LOS	AVG DEL(SEC)	AVG QUE
LT FROM A:	4	616	613	A	5.87	0.01
LT FROM B:	809	888	79	E	45.68	10.27
RT FROM C:	325	995	670	A	5.38	0.49
SHARED LT/TH FROM C:	80	0	-80	E*	INFINITE	INFINITE
ALL MOVES FROM D:	40	2	-37	E*	INFINITE	INFINITE

1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
Hartford Ave-North Main-Cedar Hill
am peak
date:01-01-1980 time:00:47:55
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=hartam GEOMETRICS=hart SIGNAL=hart
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	1	544	26	0	1	1	0	12	12	40
WB	179	182	16	1	1	0	12	12	0	40
NB	28	18	737	0	1	1	0	12	12	40
SB	28	7	1	0	1	0	0	12	0	32

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.870	5	n	17.0	3
WB	0.0%	2.0%	N	0	0	.830	5	n	17.0	3
NB	0.0%	2.0%	N	0	0	.900	5	n	17.0	3
SB	0.0%	2.0%	N	0	0	.640	5	n	17.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*				*				*		31.3	5	P
2			*				*		*	*	*		*	*	*		1.0	5	P

CYCLE= 42.3

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	1	544	26	.870	1	625	30
WB	179	182	16	.830	216	219	19
NB	28	18	737	.900	31	20	819
SB	28	7	1	.640	44	11	2

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH	626	1	1.00	626	0.00	0.00
EB	RT	30	1	1.00	30	0.00	1.00
WB	LT	216	1	1.00	216	1.00	0.00
WB	TH-RT	239	1	1.00	239	0.00	0.08
NB	LT-TH	51	1	1.00	51	0.61	0.00
NB	RT	819	1	1.00	819	0.00	1.00
SB	LT-TH-RT	56	1	1.00	56	0.78	0.03

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	VOLUME
EASTBOUND	216	219	19	100	100	74	1	1	234
WESTBOUND	1	625	30	100	100	74	0	1	647
NORTHBOUND	44	11	2	100	100	2	0	1	11
SOUTHBOUND	31	20	819	100	100	2	0	1	39

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	For	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	1.063	1894
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
WB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.464	826
WB	TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.889	1.000	1584

NB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
SB	LT-TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.896	4.027	6431

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	42	31	1	626	655	1	0.00	1	234	0.00
WB	42	31	1	216	239	216	1.00	1	647	0.00
NB	42	1	1	51	839	31	0.61	1	11	0.00
SB	42	1	1	56	13	44	0.78	1	39	0.00

CALCULATIONS

DIR	Soo	Yo	Gu	Fs	Pl	Ga	Pt	Gf	El	Fm	Flt
EB	1800	0.130	29.701	0.729	0.002	1.635	0.998	1.632	1.543	1.000	1.063
WB	1800	0.360	25.177	0.470	1.000	6.159	0.000	0.000	2.392	0.464	0.464
NB	1800	0.006	0.711	0.868	0.609	0.254	0.391	0.144	1.296	1.000	4.110
SB	1800	0.021	0.057	0.851	0.778	0.908	0.222	0.283	1.322	1.000	4.027

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	626	1894	0.33	0.74	1403	0.45	
EB	RT	30	1515	0.02	1.00	1515	0.02	
WB	LT	216	826	0.26	0.74	612	0.35	
WB	TH-RT	239	1584	0.15	0.74	1174	0.20	
NB	LT-TH	51	7325	0.01	0.02	167	0.31	
NB	RT	819	1515	0.54	1.00	1515	0.54	*
SB	LT-TH-RT	56	6431	0.01	0.02	147	0.38	

CYCLE= 42.3 LOST= 5.0 SUM V/S CRIT= 0.54 TOTAL V/C= 0.61

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	0.45	0.74	42	1.61	1403	0.16	1.00	1.77	A	1.9	2
EB	RT	0.02	1.00	42	0.00	1515	0.00	1.00	0.00	A	0.0	1
WB	LT	0.35	0.74	42	1.46	612	0.15	1.00	1.61	A	0.7	1
WB	TH-RT	0.20	0.74	42	1.27	1174	0.01	1.00	1.28	A	0.7	1
NB	LT-TH	0.31	0.02	42	15.46	167	0.34	1.00	15.79	C	0.6	1
NB	RT	0.54	1.00	42	0.00	1515	0.31	1.00	0.31	A	0.1	1
SB	LT-TH-RT	0.38	0.02	42	15.48	147	0.84	1.00	16.33	C	0.6	1

DIR	Delay	LOS
EB	1.69	A
WB	1.44	A
NB	1.22	A
SB	16.33	C

INTERSECTION DELAY = 1.84 INTERSECTION LOS=A

optimal cycle length 60.0

suggested timing phase 1 is 33.6 secs green. 5.0 secs yellow + red clear

suggested timing phase 2 is 16.4 secs green. 5.0 secs yellow + red clear

1985 HCM - CHAPTER 9: SIGNALIZED - OPERATIONAL ANALYSIS
Hartford Ave-North Main-Cedar Hill
pm peak
date:01-01-1980 time:00:42:23
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=hartpm GEOMETRICS=hart SIGNAL=hart
LOCATED IN CBD:n
VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	3	184	65	0	1	1	0	12	12	40
WB	699	476	9	1	1	0	12	12	0	40
NB	56	12	275	0	1	1	0	12	12	40
SB	9	12	1	0	1	0	0	12	0	32

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.940	5	n	17.0	3
WB	0.0%	2.0%	N	0	0	.950	5	n	17.0	3
NB	0.0%	2.0%	N	0	0	.930	5	n	17.0	3
SB	0.0%	2.0%	N	0	0	.610	5	n	17.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*				*				*		31.3	5	P
2			*				*		*	*	*		*	*	*		1.0	5	P

CYCLE= 42.3

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	3	184	65	.940	3	196	69
WB	699	476	9	.950	736	501	9
NB	56	12	275	.930	60	13	296
SB	9	12	1	.610	15	20	2

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH	199	1	1.00	199	0.02	0.00
EB	RT	69	1	1.00	69	0.00	1.00
WB	LT	736	1	1.00	736	1.00	0.00
WB	TH-RT	511	1	1.00	511	0.00	0.02
NB	LT-TH	73	1	1.00	73	0.82	0.00
NB	RT	296	1	1.00	296	0.00	1.00
SB	LT-TH-RT	36	1	1.00	36	0.41	0.05

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	VOLUME
EASTBOUND	736	501	9	100	100	74	1	1	508
WESTBOUND	3	196	69	100	100	74	0	1	247
NORTHBOUND	15	20	2	100	100	2	0	1	20
SOUTHBOUND	60	13	296	100	100	2	0	1	20

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	For	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	1.048	1867
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
WB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.733	1306
WB	TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.897	1.000	1599

NB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
SB	LT-TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.894	3.729	5940

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	42	31	1	199	265	3	0.02	1	508	0.00
WB	42	31	1	736	511	736	1.00	1	247	0.00
NB	42	1	1	73	309	60	0.82	1	20	0.00
SB	42	1	1	36	21	15	0.41	1	20	0.00

CALCULATIONS

DIR	Sad	Yo	Gu	Fs	Pl	Ga	Pt	Gf	El	Fm	Flt
EB	1800	0.282	27.024	0.557	0.016	4.312	0.984	4.203	2.018	1.000	1.048
WB	1800	0.137	29.592	0.721	1.000	1.744	0.000	0.000	1.561	0.733	0.733
NB	1800	0.011	0.507	0.863	0.824	0.458	0.176	0.140	1.304	1.000	4.347
SB	1800	0.011	0.508	0.863	0.409	0.456	0.591	0.327	1.304	1.000	3.729

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	199	1867	0.11	0.74	1383	0.14	
EB	RT	69	1515	0.05	1.00	1515	0.05	
WB	LT	736	1306	0.56	0.74	967	0.76	*
WB	TH-RT	511	1599	0.32	0.74	1185	0.43	
NB	LT-TH	73	7748	0.01	0.02	177	0.41	*
NB	RT	296	1515	0.20	1.00	1515	0.20	
SB	LT-TH-RT	36	5940	0.01	0.02	135	0.27	

CYCLE= 42.3 LOST=10.0 SUM V/S CRIT= 0.57 TOTAL V/C= 0.75

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	0.14	0.74	42	1.21	1383	0.00	1.00	1.21	A	0.6	1
EB	RT	0.05	1.00	42	0.00	1515	0.00	1.00	0.00	A	0.0	1
WB	LT	0.76	0.74	42	2.47	967	2.50	1.00	4.98	A	2.2	4
WB	TH-RT	0.43	0.74	42	1.59	1185	0.16	1.00	1.75	A	1.6	1
NB	LT-TH	0.41	0.02	42	15.50	177	0.92	1.00	16.42	C	0.8	2
NB	RT	0.20	1.00	42	0.00	1515	0.01	1.00	0.01	A	0.0	1
SB	LT-TH-RT	0.27	0.02	42	15.44	135	0.26	1.00	15.70	C	0.4	1

DIR	Delay	LOS
EB	0.90	A
WB	3.66	A
NB	3.26	A
SB	15.70	C

INTERSECTION DELAY = 3.42 INTERSECTION LOS=A

optimal cycle length 42.8

suggested timing phase 1 is 32.3 secs green. 5.0 secs yellow + red clear

suggested timing phase 2 is 0.5 secs green. 5.0 secs yellow + red clear

Hartford Ave-North Main-Cedar Hill
am peak 2005
date:01-01-1980 time:00:55:15
LAST DATA SET NAMES LOADED OR SAVED
VOLUME=hart05am GEOMETRICS=hart SIGNAL=hart
LOCATED IN CBD:n

VOLUME & GEOMETRICS

	VOLUMES			# OF LANES			LANE WIDTH			CURB TO
DIR	LT	TH	RT	LT	TH	RT	LT	TH	RT	CURB
EB	2	983	47	0	1	1	0	12	12	40
WB	323	329	29	1	1	0	12	12	0	40
NB	51	33	1331	0	1	1	0	12	12	40
SB	51	13	2	0	1	0	0	12	0	32

TRAFFIC & ROADWAY CONDITIONS

			ADJ PARK			PEDESTRIANS				ARR
DIR	GRADE	%HV	Y/N	MOVES	BUSES	PHF	CROSS	BUT	MIN TIME	TYPE
EB	0.0%	2.0%	N	0	0	.870	5	n	17.0	3
WB	0.0%	2.0%	N	0	0	.830	5	n	17.0	3
NB	0.0%	2.0%	N	0	0	.900	5	n	17.0	3
SB	0.0%	2.0%	N	0	0	.640	5	n	17.0	3

PHASINGS

	EASTBOUND				WESTBOUND				NORTHBOUND				SOUTHBOUND				GREEN	Y+R	PRE/ACT
	l	t	r	p	l	t	r	p	l	t	r	p	l	t	r	p			
1	*	*	*		*	*	*				*				*		31.3	5	P
2			*				*		*	*	*		*	*	*		1.0	5	P

CYCLE= 42.3

VOLUME ADJUSTMENT WORKSHEET
PART 1 (MOVEMENT ADJUSTMENTS)

DIR	LTV%	THV%	RTV%	PHF	LTFR	THFR	RTFR
EB	2	983	47	.870	2	1130	54
WB	323	329	29	.830	389	396	35
NB	51	33	1331	.900	57	37	1479
SB	51	13	2	.640	80	20	3

PART 2 (LANE GROUP ADJUSTMENTS)

DIR	LN GROUP	FLOW	N	LU	v	Plt	Prt
EB	LT-TH	1132	1	1.00	1132	0.00	0.00
EB	RT	54	1	1.00	54	0.00	1.00
WB	LT	389	1	1.00	389	1.00	0.00
WB	TH-RT	431	1	1.00	431	0.00	0.08
NB	LT-TH	93	1	1.00	93	0.61	0.00
NB	RT	1479	1	1.00	1479	0.00	1.00
SB	LT-TH-RT	103	1	1.00	103	0.77	0.03

PART 3 (OPPOSING VOLUME ADJUSTMENTS)

LEFT TURN BEING OPPOSED	OPPOSING APPROACH VOLUMES			% IN PHASE WITH LEFT			# LANES		OPPOSING
	LT	TH	RT	LT	TH	RT	LT	TH	VOLUME
EASTBOUND	389	396	35	100	100	74	1	1	422
WESTBOUND	2	1130	54	100	100	74	0	1	1170
NORTHBOUND	80	20	3	100	100	2	0	1	20
SOUTHBOUND	57	37	1479	100	100	2	0	1	70

SATURATION FLOW ADJUSTMENT WORKSHEET

DIR	LN GROUP	IDEAL	N	Fwid	Fhv	Fgr	Fpark	Fbus	Farea	Frt	Flt	s
EB	LT-TH	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	1.062	1893
EB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
WB	LT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	1.000	0.172	307
WB	TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.889	1.000	1584

WB	RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.850	1.000	1515
SB	LT-TH-RT	1800	1	1.000	0.990	1.000	1.000	1.000	1.000	0.896	3.987	6366

SUPPLEMENTAL WORKSHEET FOR LEFT-TURN ADJUSTMENT FACTOR FLT

INPUT VARIABLES

DIR	C	G	N	Va	Vm	Vlt	Plt	No	Vo	Plto
EB	42	31	1	1132	1184	2	0.00	1	422	0.00
WB	42	31	1	389	431	389	1.00	1	1170	0.00
NB	42	1	1	93	1399	57	0.61	1	20	0.00
SB	42	1	1	103	23	80	0.77	1	70	0.00

CALCULATIONS

DIR	Soo	Yo	Gu	Fs	Pl	Ga	Pt	Gf	El	Fm	Flt
EB	1800	0.235	27.975	0.611	0.002	3.361	0.998	3.352	1.841	1.000	1.062
WB	1800	0.650	10.978	0.144	1.000	20.358	0.000	0.000	7.823	0.172	0.172
NB	1800	0.011	0.491	0.862	0.607	0.473	0.393	0.257	1.305	1.000	4.029
SB	1800	0.039	0.000	0.831	0.773	0.964	0.227	0.300	1.354	1.000	3.987

CAPACITY ANALYSIS WORKSHEET

DIR	LN GROUP	v	s	v/s	g/C	c	v/c	CRITICAL
EB	LT-TH	1132	1893	0.60	0.74	1402	0.81	
EB	RT	54	1515	0.04	1.00	1515	0.04	
WB	LT	389	307	1.27	0.74	228	1.71	*
WB	TH-RT	431	1584	0.27	0.74	1174	0.37	
NB	LT-TH	93	7180	0.01	0.02	164	0.57	
NB	RT	1479	1515	0.98	1.00	1515	0.98	
SB	LT-TH-RT	103	6366	0.02	0.02	145	0.71	*

CYCLE= 42.3 LOST=10.0 SUM V/S CRIT= 1.28 TOTAL V/C= 1.68

LEVEL OF SERVICE WORKSHEET

DIR	LN GROUP	v/c	g/C	C	d1	c	d2	PF	Delay	LOS	Avg Q	95% Q
EB	LT-TH	0.81	0.74	42	2.69	1402	2.55	1.00	5.23	B	3.4	6
EB	RT	0.04	1.00	42	0.00	1515	0.00	1.00	0.00	A	0.0	1
WB	LT	1.71	0.74	42	-4.05	228	757.83	1.00	753.78	F	82.1	245
WB	TH-RT	0.37	0.74	42	1.48	1174	0.09	1.00	1.58	A	1.3	1
NB	LT-TH	0.57	0.02	42	15.55	164	3.41	1.00	18.96	C	1.1	2
NB	RT	0.98	1.00	42	0.00	1515	13.28	1.00	13.28	B	5.5	17
SB	LT-TH-RT	0.71	0.02	42	15.60	145	9.88	1.00	25.48	D	1.3	3

DIR	Delay	LOS
EB	5.00	A
WB	358.35	F
NB	13.62	B
SB	25.48	D

INTERSECTION DELAY = 87.99 INTERSECTION LOS=F

optimal cycle length 120.0

suggested timing phase 1 is 108.6 secs green. 5.0 secs yellow + red clear

suggested timing phase 2 is 1.4 secs green. 5.0 secs yellow + red clear